May 1929

Electrical Manufacturing

Vol. 3 A Gage Publication No. 5

49
1/28

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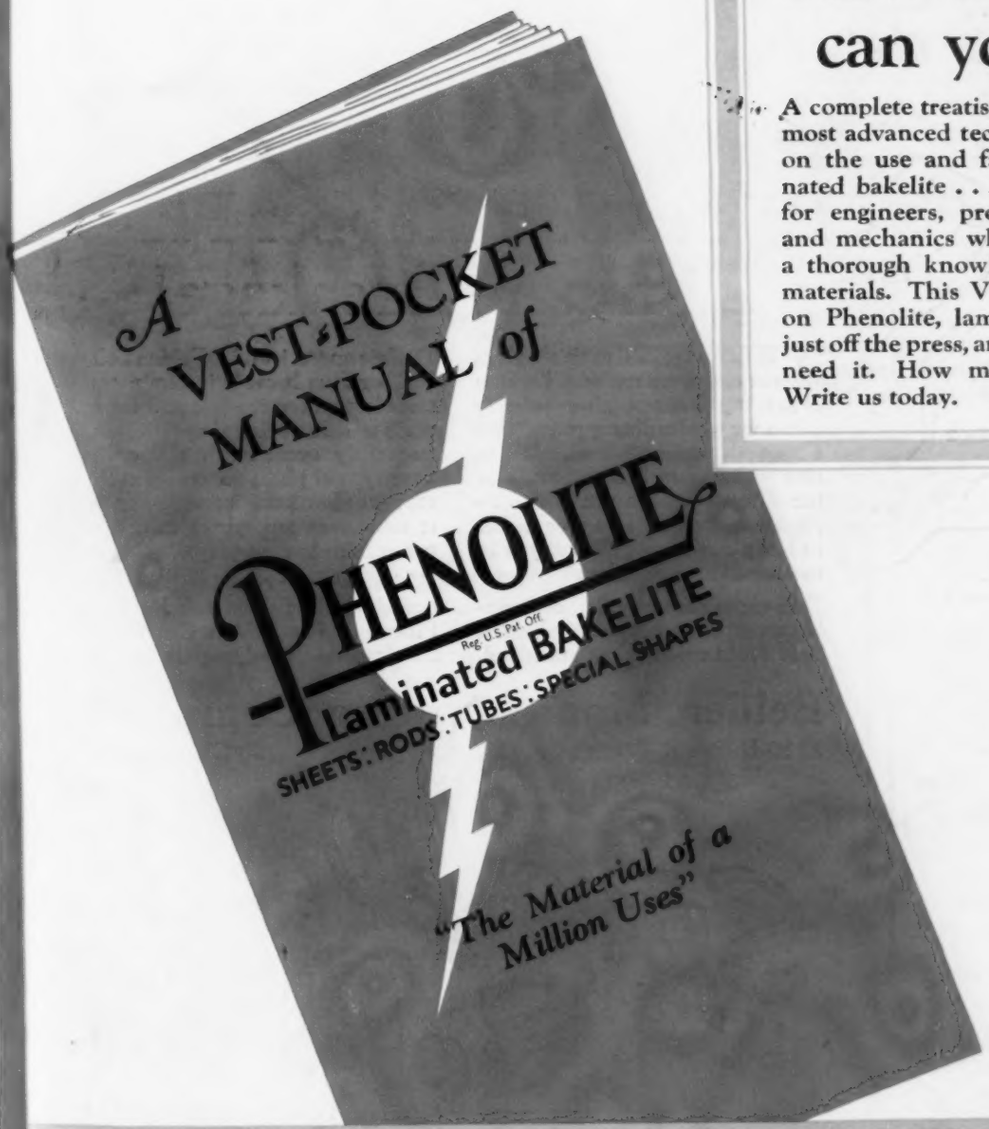
A complete treatise, incorporating the most advanced technical information on the use and fabrication of laminated bakelite . . . written especially for engineers, production managers and mechanics whose work requires a thorough knowledge of insulating materials. This Vest Pocket Manual on Phenolite, laminated bakelite, is just off the press, and free to those who need it. How many can you use? Write us today.



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You can bang the Belden Soft Rubber Plug against a fine piece of furniture. It will not scratch the furniture or hurt the plug.
Belden

Inserting ordinary plugs in receptacles that do not fit perfectly often causes breakage. Prongs of the Belden Soft Rubber Plug spread or come together to fit the receptacle without breakage.

Fig. 1

For example, a strong pressure with the fingers will force the prongs together (Fig. 1) but they come right back to the correct position when released (Fig 2). In service the receptacle holds the prongs rigidly in position. (Listed as standard by Underwriters.)

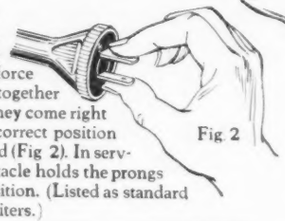

Fig 2

Belden Soft Rubber Plugs Eliminate Breakage!

"TWENTY-FIVE to thirty plugs per day were replaced because of breakage during or after assembly when we used ordinary plugs," said a large radio manufacturer. "Since standardizing on Belden Soft Rubber Plugs we have not had to replace or adjust a single plug, either in our plant during assembly or in the hands of our dealers."

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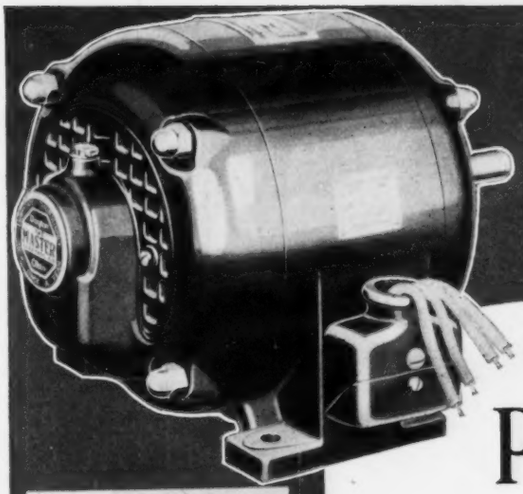
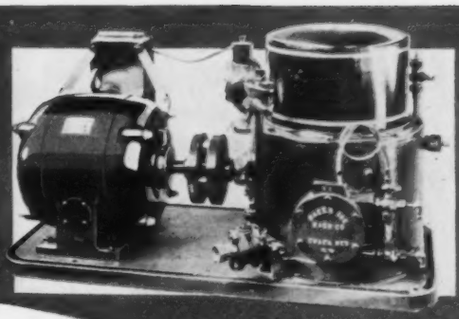
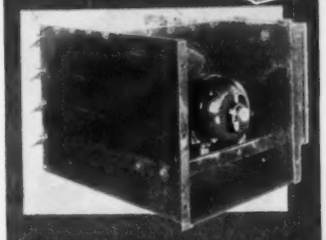
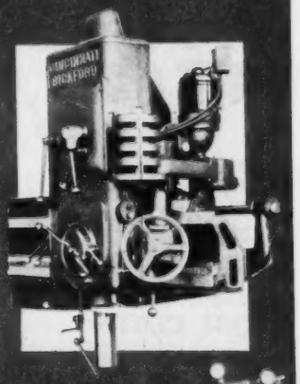




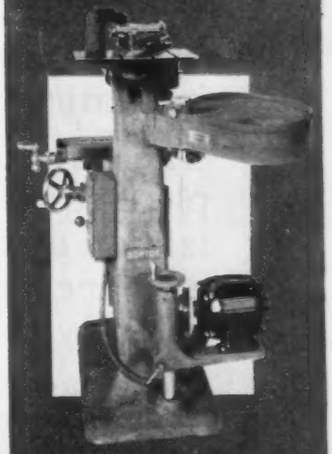
Popularity



MORE *than sixty manufacturers of pumps; fifty manufacturers of woodworking machinery; fifteen manufacturers of air compressors, and many others* know by experience that Master Motors can be depended on. They know that every Master Motor is a thoroughbred—born of the Master ideal to always produce a better product.



Master Motors are popular — because the *entire* Master organization works in a harmony of spirit that is possible only where employee and employer respect and understand each other.



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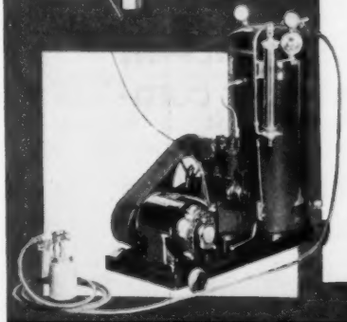

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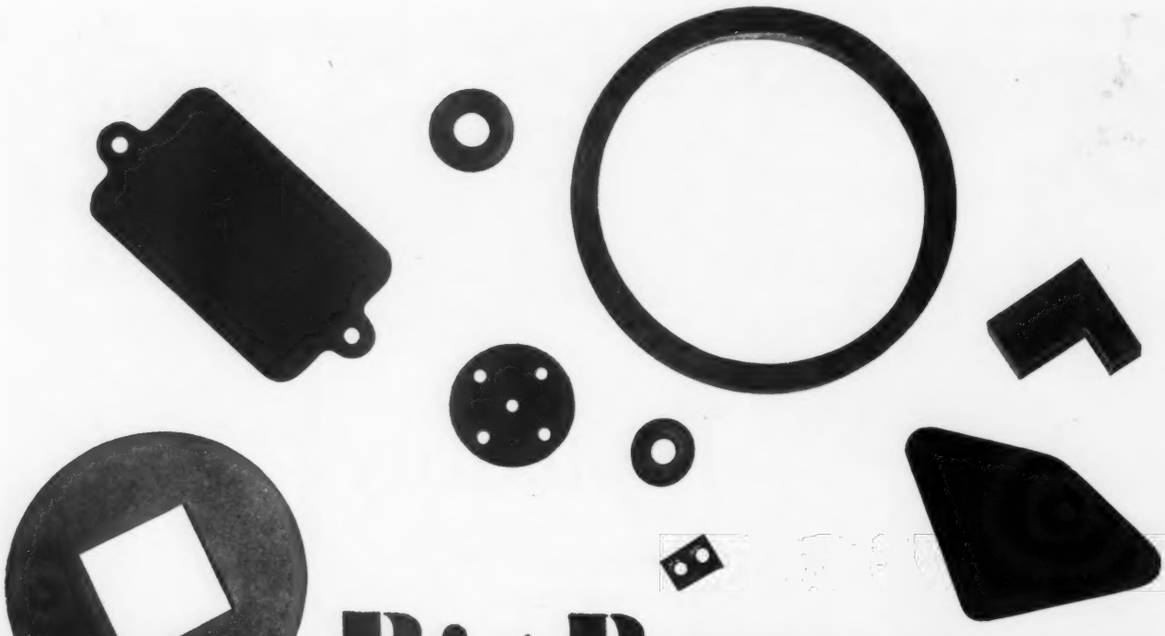

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Electrical Manufacturing

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Volume 3 | MAY, 1929 | Number 5

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Electrical Manufacturing's editorial program has the following objectives:

Production

To help all electrical manufacturers, including makers of motor-driven products, increase the product's salability, cut unit production costs, quicken turnover, reduce overhead expenses, establish standard methods of work, and spread a better knowledge of raw materials and parts.

Marketing

To spread a better knowledge of and aid electrical manufacturers in adjusting sales management to the buyers' market, to aid in making advertising more effective, finding the most profitable distribution channels, and promoting cooperative market development.

Administration

To further the working out of sounder management policies and better executive control, coordinating sales and production schedules, promoting research, and developing better industry relations.

Repairing

To help all motor repair shops to build better business by developing a sounder organization, improving management, policies and methods, and developing a keener merchandising point-of-view on the business.

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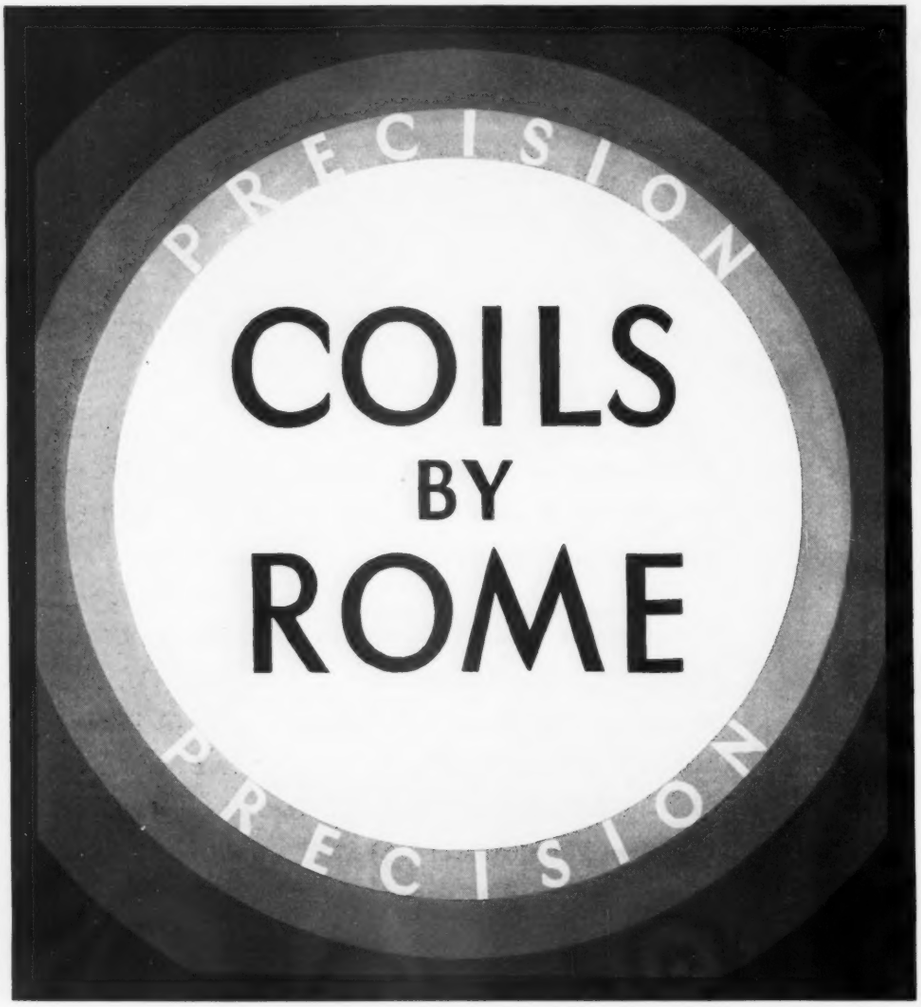

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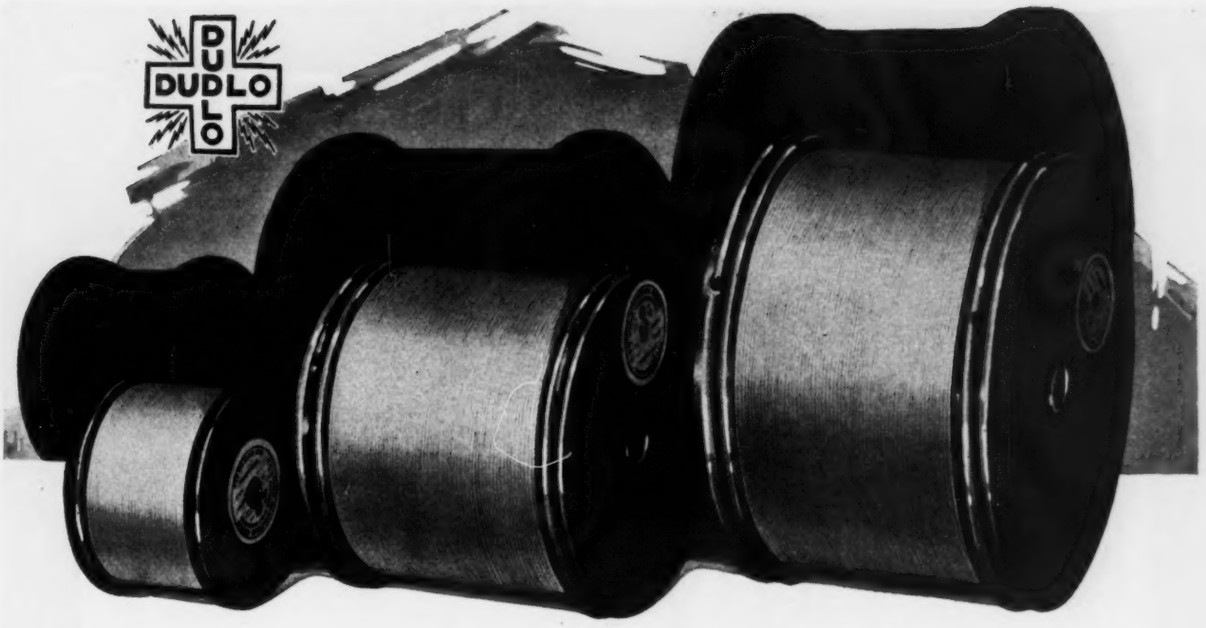

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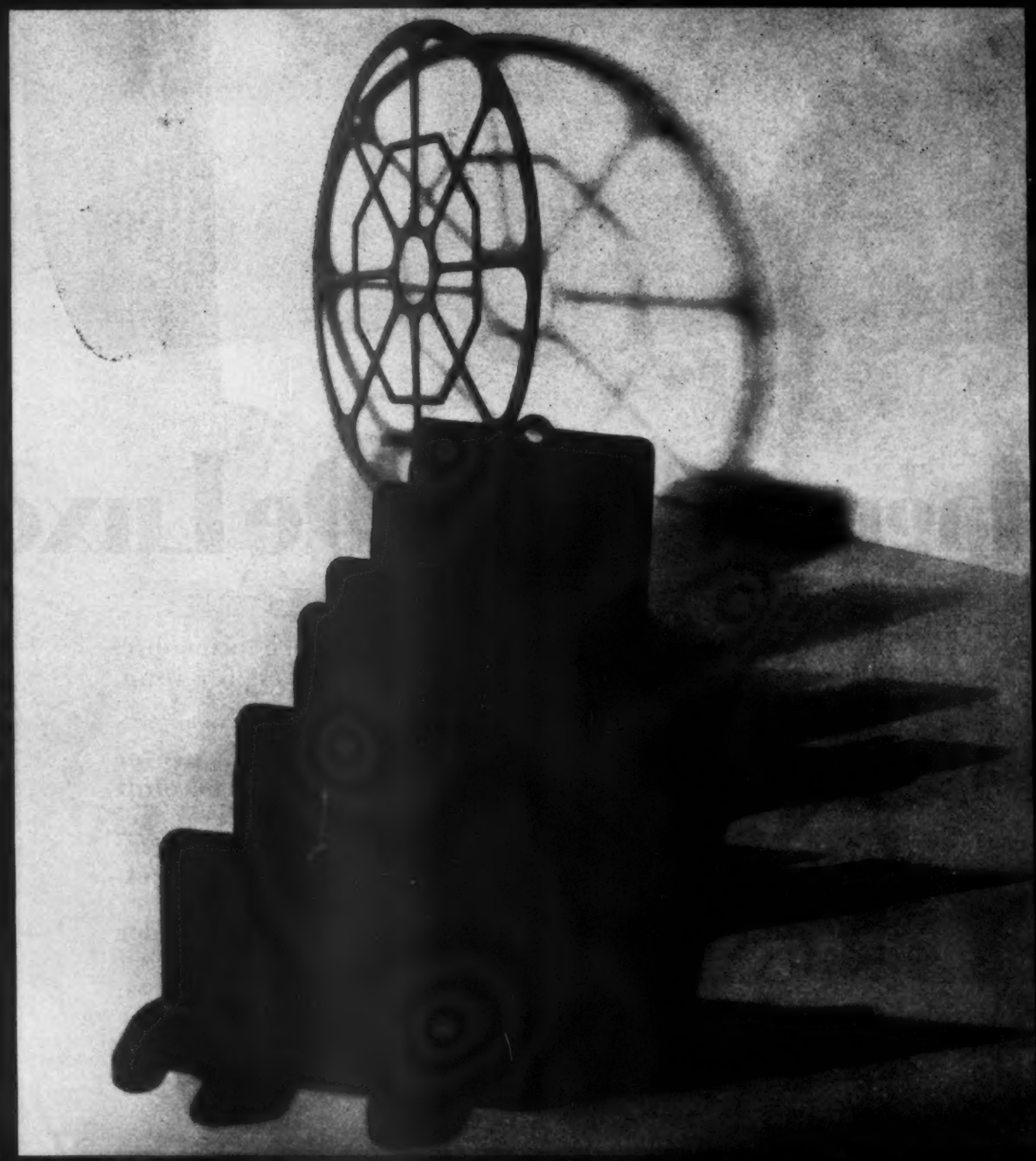

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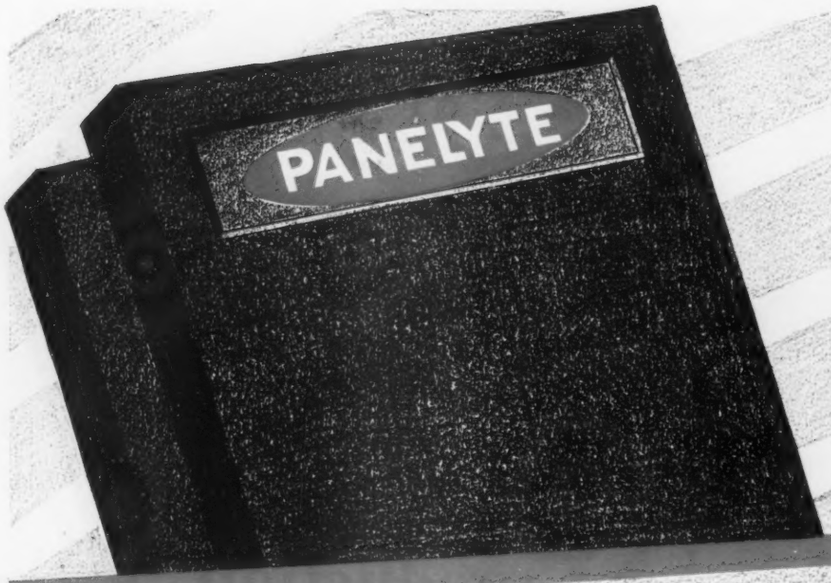

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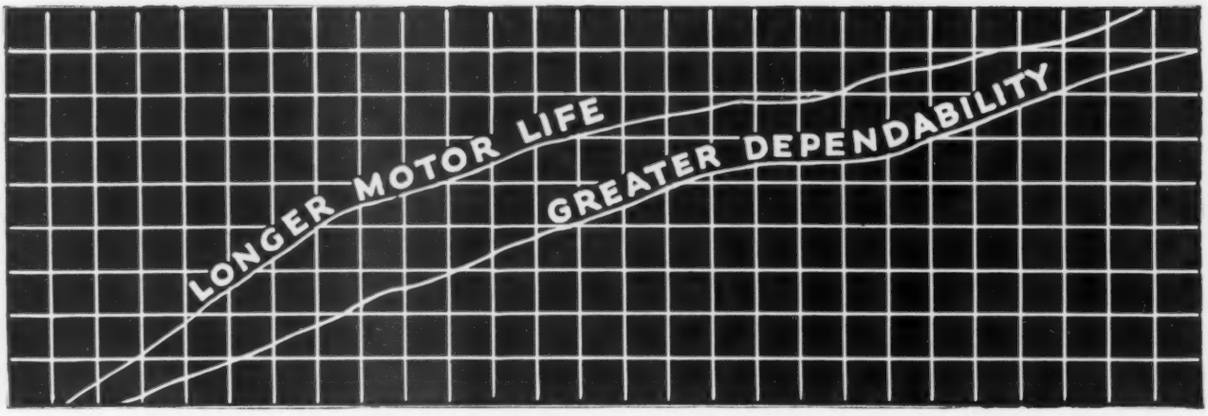

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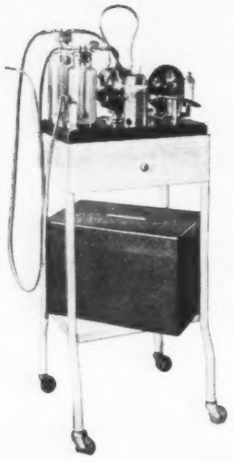

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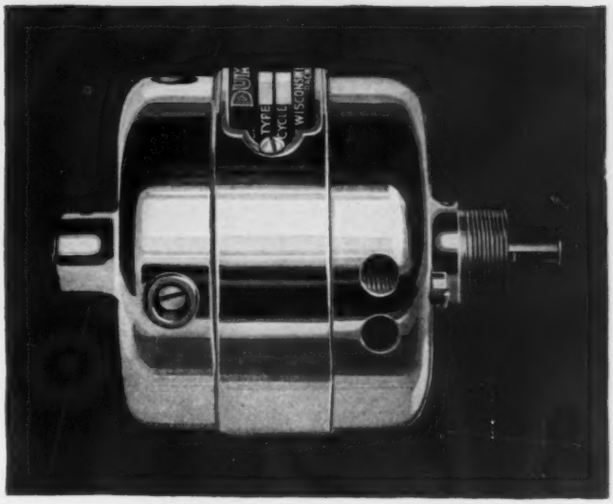

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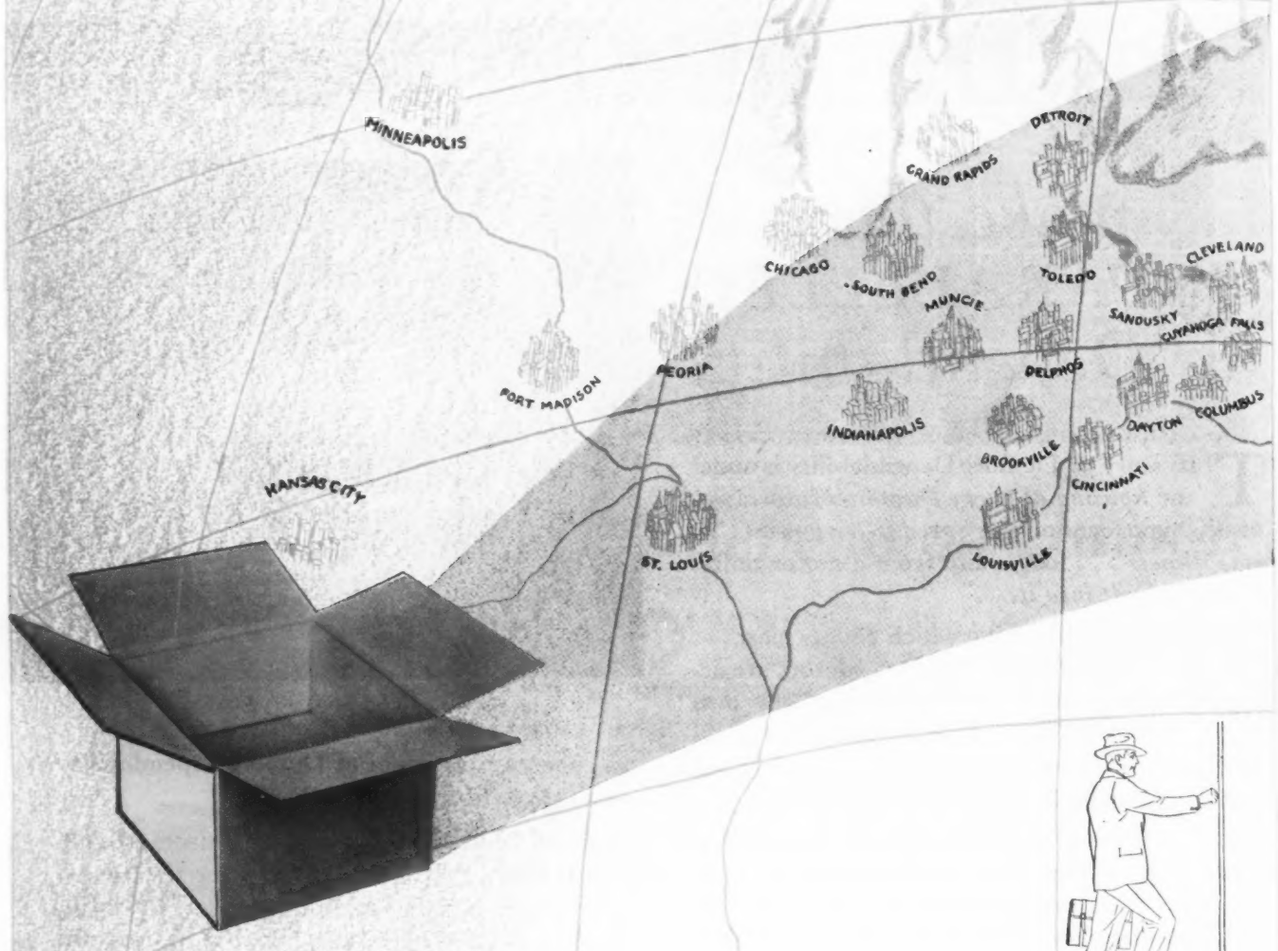

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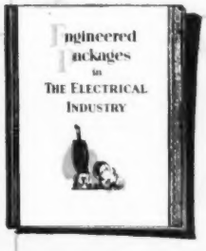
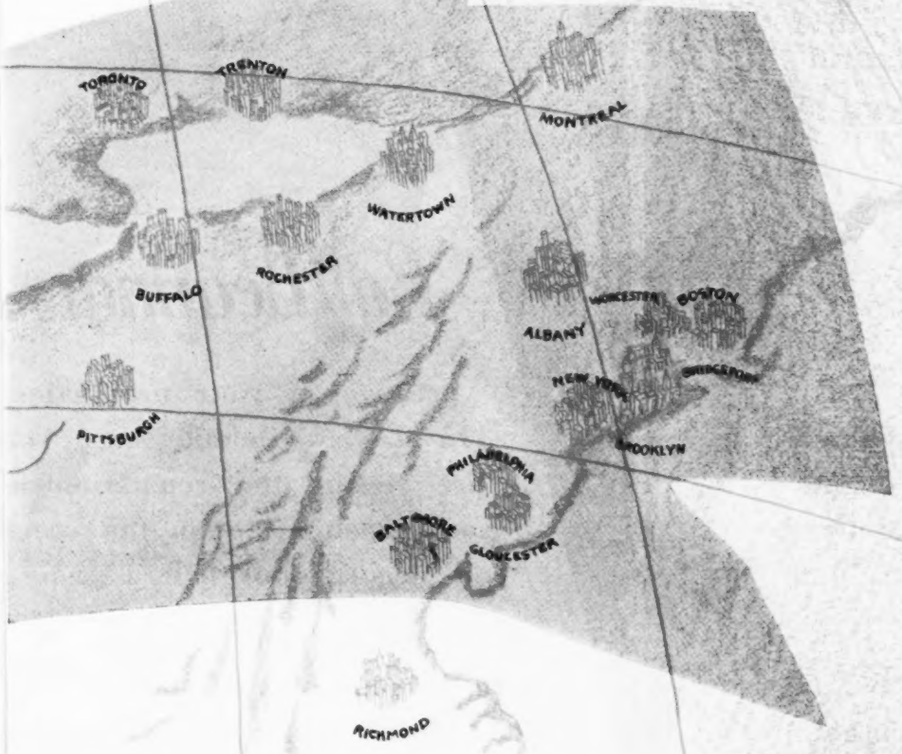


Packaging Service

area of the



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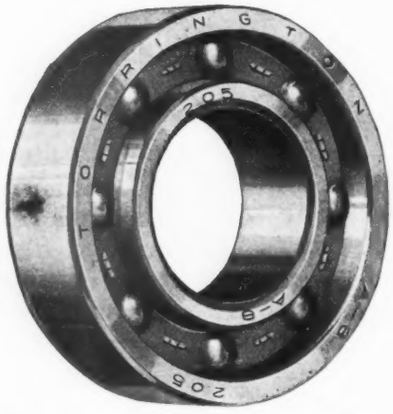

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Every day new uses are being found for these materials—uses which make the product better—less costly—possessing a new talking point.

You may have had the subject up with other molders but give yourself the satisfaction of having given this organization (students and the Grand Father of the Industry) an opportunity of assisting you. This advice is free.

Send us samples, drawings and specifications.

CELLULOID-BAKELITE DIVISION of

Auburn BUTTON WORKS Inc.

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62% Lighter than Iron

Iron is an age old metal and like many other substances used down through the centuries is going more and more out of use. This is due to the development of newer metals which have all the advantages of iron but none of its disadvantages.

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The value of Bohnalite is twofold. Its use not only reduces the weight of your product, but it likewise increases its attractiveness and usefulness.

Manufacturers prefer Bohnalite because of its high uniform hardness — great density — fine grained structure — exceptional strength — excellent bearing qualities — ductility and lightness.

Many of these important refinements are due to the special processes and series of heat treatments developed by Bohn metallurgists over a long period of years.

We have ready a new book about Bohnalite which explains and illustrates the wide use of this new light alloy which is so rapidly replacing iron and other heavy metals. Send for a copy today.

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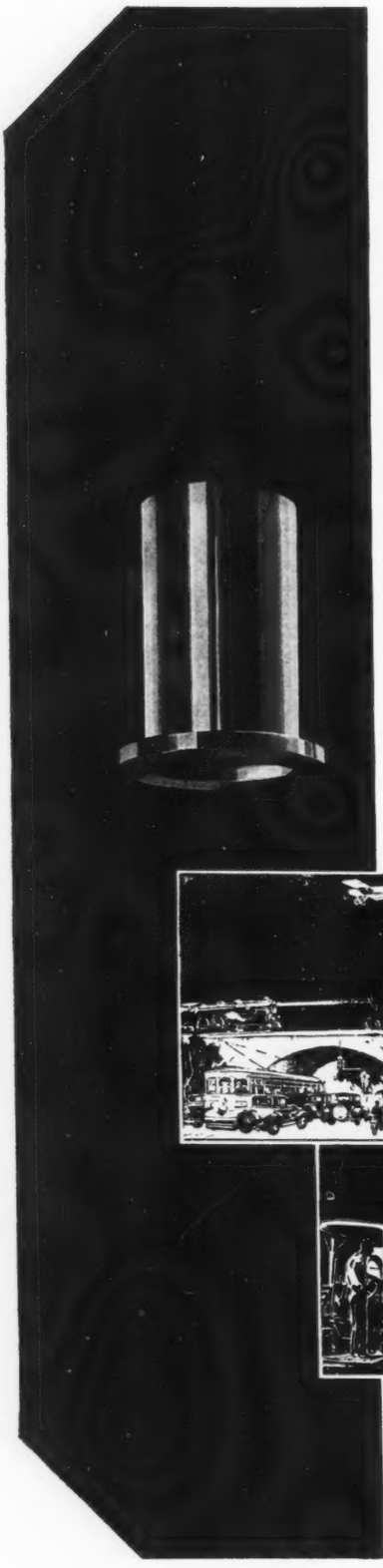
Send for This Book

Throughout THE LENGTH AND BREADTH of Industry



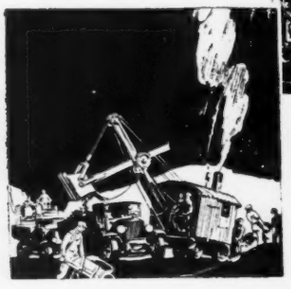
Just when bronze, earliest of the alloys, came into common usage as bearing metal is difficult to determine. It is a known fact, however, that during the past quarter-century more bronze bearings have been made and used than any other kind.

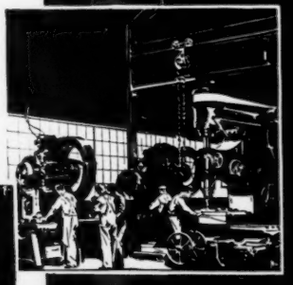
Thruout the length and breadth of industry lives the conviction that for practical utility and economy there is no substitute for bronze bearings.

The reasons for this preference are readily apparent. Bronze yields smooth, solid, perfect castings in any size and shape. It possesses qualities of self-lubrication. and thus reduces to a minimum the possibility of scoring and seizing shafts.

Ideal bronze withstands compression loads under heat, has adequate tensile strength, elastic limits and moderate Brinell hardness. Coefficient of expansion is uniform. Coefficient of friction is low and abrasive elements are absent at all temperatures.

Withal. bronze bearings for most installations cost substantially less per unit and possess out-of-the-ordinary longevity. When replacement is necessary, it is accomplished easily and economically.





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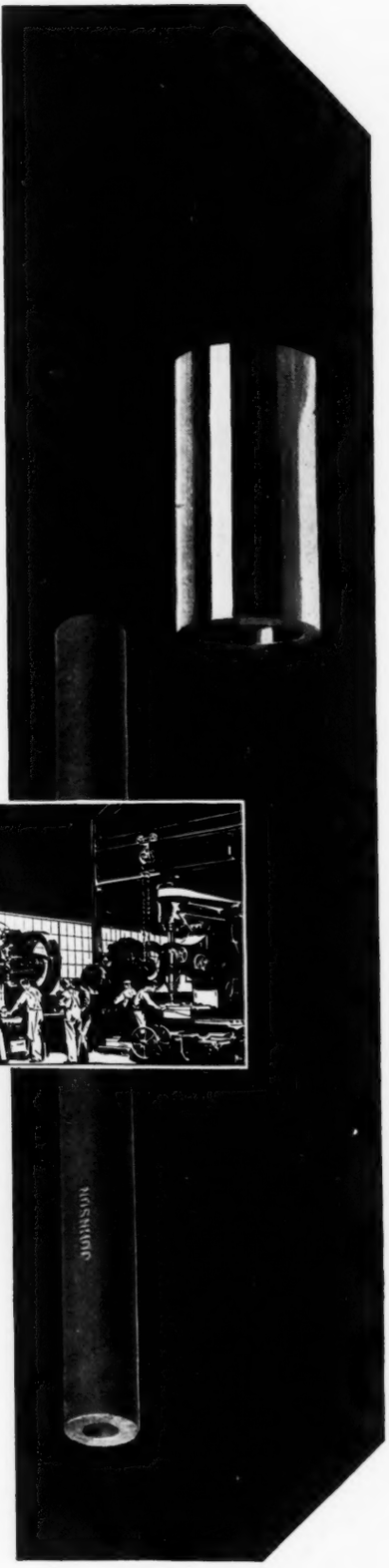
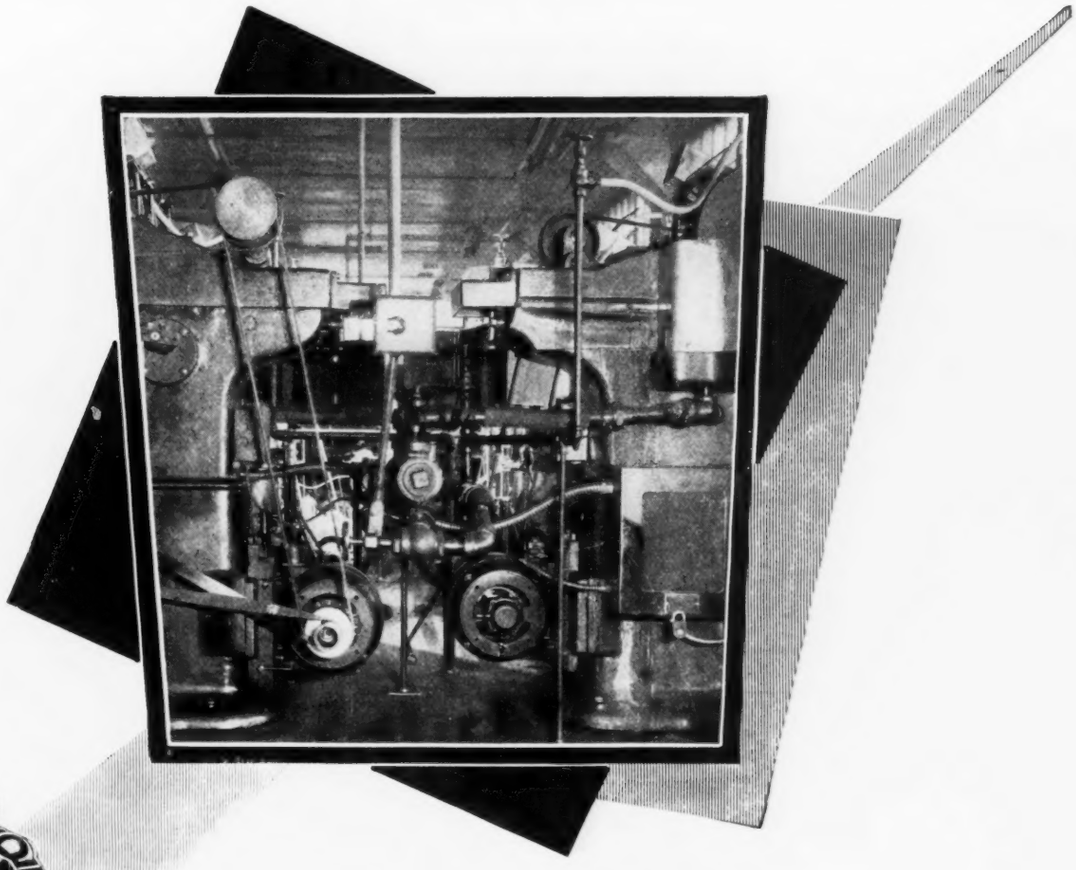
NEW CASTLE, PA.



JOHNSON BRONZE

BUSHINGS BEARINGS BAR BRONZE



Are You Pouring Oil Into Thirsty Motors?

LONG ROWS of motorized production grinders — set closely together — back to back — motors hidden in a maze of electric conduits and compound pipes.

Picture to yourself the task and cost of oiling these thirsty motors each week.

Two grinders from such a production line are shown above with their individual motors.

In this instance, however, oiling is not a problem, for the Westinghouse Motors are equipped with New Departure Ball Bearings.

With housings well filled with grease, they go on and on for months and months with no attention whatever,—no reassembly of the motors is necessary for mounting on vertical bed plate, as shown.

There are pages and pages of reasons why ball bearing motors are superior, all of which we have bound up in two little booklets—"Cutting Your Costs" and "Booklet K." A request will bring either or both. The New Departure Mfg. Co., Bristol, Connecticut; Detroit, Chicago, San Francisco, London.

NEW DEPARTURE

BALL BEARINGS

1187

G-E Flex . . . . .

the electric cord for portable tools

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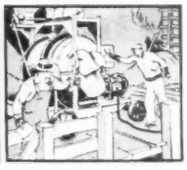
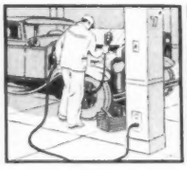
Household Appliances



Construction Machinery

Electric Drills



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A portable tool can't be really efficient if it has a cord that kinks and tangles. That's why so many progressive manufacturers have adopted G-E Flex.... the better electric cord.

Not only for electric tools, but for lamps and household appliances, this cord is now being extensively used. It has great toughness, high tensile strength. Neither acid, nor oil nor water will harm it. It is all-rubber covered.

G-E Flex comes on spools and in coils or in cord sets with molded rubber plug permanently attached, all ready for assembly. You should know all about this efficient new General Electric product. Mail the coupon for details.

Section W-235, Merchandise Department,
General Electric Company,
Bridgeport, Connecticut.

Please send me full information on G-E Electric Cord and Cord Sets.

Name .....

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GENERAL ELECTRIC

Electrical Manufacturing

Production - Marketing - Administration - Repairing

Volume 3 **MAY - 1929** **Number 5**

Let's Untie These Knots

Progress in electrical manufacturing seems to be hampered somewhat pending the unsnarling of nearly a score of knotty questions covering many phases of marketing, production and administration

LACK of balance between production and consumption, ruinous prices, narrowing margins of profit, keeping ahead of competitors, increasing number of middlemen, unnecessarily high costs of distribution, power company competition, uneconomical selling, how to expand markets, off-standard devices, development, threat of radical changes in products, elimination of unnecessary types and styles and sizes, substandard materials and appliances, unintelligent management, future costs and difficulties with company personnel—these are some of the more important problems that are troubling executives in the electrical manufacturing field today.

At least these are the knotty questions which leading electrical manufacturers would like to have unsnarled, according to many letters that have come to the editor of ELECTRICAL MANUFACTURING recently, in response to his inquiry addressed to several hundred concerns in the field. Quite frankly these manufacturers express their difficulties with the troublemakers listed above, and if anyone can bring in an adequate and a lasting solution to any of the problems he will be welcomed enthusiastically in scores of electrical factories up and down the land. Apparently the industry is looking for someone to cut a hundred Gordian knots.

Replies to the editor's inquiry were received from engineers, sales managers, presidents, vice-presidents, department managers, research managers, technical men, production managers and other executives. Inspection of their letters indicates how greatly marketing problems in many forms are troubling the manufacturing group in the electrical industry. Production problems, important though they may be, are not emphasized in these letters. Next to marketing problems, the things that trouble most seem to be administrative problems, problems that emphasize the big question, "What lies ahead?"

For the benefit of the readers of ELECTRICAL MANUFACTURING, the editor quotes below portions of a number of the more thoughtful letters. It is not necessary to reveal the writer's identity in any instance. The reader has the editor's assurance that every letter quoted is from a manufacturing executive whose name would immediately command a hearing anywhere in the industry.

Excess Plant Capacity

"Swapping dollars" apparently results from a condition that has been brought about by the lack of balance between plant capacity and selling, according to the following letter:

> The paramount problem of the electrical manufacturer today is one of distribution. Successful electrical manufacturers have developed excellent production efficiency.
>
> As is true with so many industries today, there is excess capacity, and this has existed ever since the war, and consumption has not yet caught up with capacity. This excess capacity has naturally forced the price of electrical products to a minimum, and to a point where in spite of efficient production manufacturers are practically "swapping" dollars.
>
> Most raw and semi-finished materials are selling at approximately 50 per cent above pre-war prices; this is true of materials required for electrical products. Labor to produce these products is obtaining from 125 per cent to 150 per cent more than the wages existing prior to the war. The prices of electrical products have not increased to any such extent, with the result that efficient operation cannot offset the higher costs of labor and material.
>
> During and since the war, distribution expense has tremendously increased and electrical manufacturers must pay unheard of sales and engineering expense to obtain even their fair share of the volume necessary to operate their plants at anything like capacity. Solutions of these difficulties are not apparent. Gradually the growth of the country and the many additional uses for electrical products will correct the excess capacity condition. However, a fair profit cannot be made until prices for electrical products are consistent with costs of labor and material.
>
> It is our own opinion that prices of electrical products will be increased to a certain extent and costs for labor and material decreased to some extent until the proper balance is obtained, but this will require still further time, and for more than ten years this re-adjustment has not been accomplished. As is always true, the weaker must succumb and the stronger will eventually work out of their difficulties, and there will probably develop certain consolidations, especially distributing consolidations, before business will be on a healthy basis.

Destructive Competitive Prices

Some indication of the damage that can be done on a broad scale by ruinous prices is pointed out in the following letter:

There seems to be no desire on the part of a number of manufacturers to develop quality products and dispose of them at a reasonable and sufficient profit by the use of salesmanship. A number of them, in fact far too many for the good of the industry, appear to believe that the justification of their existence lies in producing something that can be sold more cheaply than existing standardized products by virtue of inferior material and workmanship. Invariably the manufacturer of such material does his selling by one of two means. He either determines the prevailing price for standard apparatus on the market and quotes 5 or 10 per cent under it, or else he learns from grasping purchasing agents what prices they have been quoted on the same apparatus and offers them flatly a certain percentage of additional discount.

What eventually happens? Reputable manufacturers distributing standard equipment at legitimate prices are faced with the possibility of losing their distribution in certain territories and decide that they will "teach the disturber a lesson." Nine times out of ten the result is a lowering and a spreading of the same condition to the whole country.

In my opinion the question of more economical production has been recognized to such an extent that most manufacturers have now taken steps to stop any "leaks" that were apparent. Although the rearrangement of production facilities is still going on—a great deal of the work has been done and it seems to me that in the future stress will be laid upon the necessity of obtaining adequate prices for material sold.

And this one:

The two important problems that confront the electrical manufacturer today are production of a uniform product and constructive distribution of these products. The latter problem has been the more serious of the two. I think that the entire industry would be benefited if some of our manufacturers appreciated the importance of proper merchandising with particular regard to destructive competitive prices for legitimate merchandise. My solution of this latter problem may not be quite legal but it amounts to just this. A curb should be put on production because there seems to be an over production of almost every electrical item and in the manufacturer's desire to keep this production going, there is a disregard for fair prices.

Another on the same point:

We may have no solution for this commercial problem that is always at hand. In times of great industrial activity, such as we are having at this time, it seems unnecessary and needless that some manufacturers should quote destructive and ruinous prices when volumes are available such as we have at this time. This may be due to expert technique and pressure on the part of purchasing agents and buyers. If this is the cause of ruinous prices being offered in times such as these, the only answer is—more business courage on the part of sales managers and salesmen.

Buying Under Closer Limits

An increasing tendency to buy under closer specifications is making trouble for some manufacturers. One of them analyzes this problem as follows:

The following point is particularly apropos. It covers a tendency which has been growing. There is an honest desire and effort, on the part of all manufacturers, to reduce costs and one method which can be employed to do so is the purchase of raw materials which will eliminate various manufacturing testing operations, or buying under closer specifications, or, possibly, buying material nearer the finished and useable form than heretofore.

All of this is encouraging buyers and engineers to demand material to closer limits than previously purchased and all of these changes and refined requirements and new ideas of materials are expected without an increase in the cost of the commodity. This merely transfers the cost from the user to the supplier without giving the supplier a chance to make additional charges for it. This tendency is perfectly proper but is working a tremendous hardship in many cases upon suppliers. In other words, the buyers are becoming more conscious of their particular and special requirements and are expecting to buy raw materials, especially in the lines of special materials, of greater accuracy and to fulfill more special purposes without additional cost.

This simply narrows the margin of profit of many of our manufacturers. I consider that this represents a problem in all special lines of manufacture.

Must Outstrip Competitors

And here is one manufacturer who thinks that Henry Ford's effort to make "a lady out of Lizzie" may well be taken to heart by certain electrical manufacturers. He writes:

The problems of the electrical industry are exactly the problems of every other industry and are not many but just one. That one is expressed in the statement that it is incumbent on a successful manufacturer to do his job better than his competitor. If he does it, he has very little trouble of either production, distribution, or reputation. He makes money, he is happy, he pays his bills and he brags about his country. However, when he does not do his job as well as his competitor, then he has all manner of trouble. Perhaps the trouble is not in production because he has very little to produce—it may look as if his trouble were distribution. However, his fundamental difficulty is the fact that he is not doing his job and his competitor is.

To illustrate my point, The Ford Company had a good deal of difficulty in 1928 in selling a volume of model T Ford cars. Certainly it had no trouble in production, as it could produce 10,000 of these a day as it had done for some time before. It might have thought it was having trouble in distribution since it could not get the volume of sales it required. However, its trouble was not distribution. This was merely the evidence of that trouble. The real trouble was the fact that the model T Ford was out-moded. In other words, the Ford Company was not doing the job as well as its competitors. As a matter of fact therefore, production was wrong, distribution was wrong, and certainly the balance sheet was all wrong.

This same illustration may be applied to every other company that is having difficulty at the present time in making a satisfactory profit. It problably is not doing its job as well as its competitors. When it does it will have no further trouble. As long as it does not, however, it is going to have a good deal of difficulty in satisfying stockholders on dividend day.

Too Many Poor Middlemen

Probably many manufacturing executives will agree with the analysis made by one company official who expresses his troubles with distribution as follows:

Production has been reduced to more or less of an exact science, and effective economies including labor saving devices and materials follow naturally and with reasonable speed, but the necessity for increased stock volume and the expansion of stocks carried in different localities; the difficulty of adopting a satisfactory and workable definition for the different classes of trade, i.e., consumer, contractor, dealer, jobber or wholesaler; the amount of missionary work that the manufacturer should do; and the reasonable function of each class are so far without solution. The rapidly increasing number of wholesalers and contractors, and the tendency on the part of the former to ignore the terms of sale of the manufacturers, and to adopt their own terms, are the most disturbing factors in the distributing end of the business.

Cost of Selling Too High

And this one spotlights another reason why costs of distribution are unnecessarily high:

In our opinion, without doubt, our most serious problem is that of distribution. Also the abnormal and in many instances apparently unnecessarily high cost of distribution, is a most serious factor. Closely connected with this is the problem of unfair competition from, in some cases legitimate competitors, but in most cases from concerns who have no standards of business ethics, to use a mild word. Such concerns never hesitate to use substandard material, and to turn out a product which they hope will "just get by." As it is a physical impossibility for electrical inspectors to make a 100 per cent check, many of these articles escape discovery and are in daily use. When a manufacturer, having at least some regard for business standards and some pride in his products is confronted with this substandard material situation, it produces a condition of extreme hardship.

Central Station Competition

Power company competition is often unfair, judging from the following letter, which reveals some of the troubles the independent manufacturer has in gaining distribution:

The problem of production is simple. We can make all the ranges we can sell. But the great problem right now and for the last fifteen years for that matter, as far as our product is cancerned, is that we cannot interest dealers, because of power company competition. Merchandising is being hampered and in fact stamped out by freak practices and cut prices. It is easy to sell goods, but as soon as the dealer finds out what he is up against, he loses heart and quits. So, instead of working every State in the Union now, we are confined to such States as have a market, due to reciprocity from power companies. Many important utility properties are practically closed to the independent manufacturer.

Must Cut Selling Costs

Many letters stressed the need for more economical selling methods, as indicated by this letter:

I am of the opinion that the development of new ways and improvement of current ways and means for discovering additional prospects for our products, and providing enough thoroughly trained salesmen to give such prospects timely and adequate attention without undue expansion in the ratio of expense to orders secured—in short, more effective and economical methods of securing business are of more importance than problems of production. While commercial control of production is always a most important and serious factor, with access to more comprehensive statistics and better means of forecasting demand, supervising production, and regulating stocks, problems of production have become secondary for the present to problems of distribution and sale.

How Limited Are Markets?

Two letters reflected the oft-expressed need for wider markets as follows:

From the standpoint of the manufacturing of electric heating devices, I feel that the first great need is expansion of the market. The Electrical Industry Sales Conference will help in proportion to the scale and character of its final program. We hope that the appropriation will be in keeping with the opportunities and that the appeal will be well calculated to win the objective and to challenge other industries, who have been making such successful bids for the consumer dollar.

The N. E. L. A. Concurrent Advertising campaigns have also demonstrated far reaching possibilities which, if more widely extended and more intelligently applied, will develop the market, I feel sure. This, we are working to accomplish in a systematic way, but unwise price cutting and premiums will hurt both the public service companies and the manufacturers, if not modified, but this is receiving thoughtful consideration.

Market expansion would partially offset another serious difficulty, which is the overcrowding of our industry by many manufacturers in recent years who have been lured into it. Some of these were formerly making other specialties and had unemployed facilities or equipment which could be diverted into the heating device line. This has resulted in lower profits than normal.

And this one also:

Let me emphasize this by saying that you know as well as I do that a public utility will buy an electric meter only when a customer has been secured to use that meter. All the advertising and pressure that could be brought to bear would not cause a public utility to buy one more meter than they need. Therefore our business is entirely dependent upon the number of new customers and a small percentage of the replacement meters that are connected every year. The demand now is considerably less than two years ago, because at that time you had the house wiring campaigns that brought up the total requirements. Now we have so many wired homes that the possible percentage increase in the number of customers is much less than it was in previous years. The public utilities recognize that and have recognized it for some years, because you know their slogan is "Sell more kilowatthours per customer."

Ordering Special Combinations

And this executive spotlights a cause of trouble which is not frequently mentioned in discussions of electrical manufacturing problems, but which seems to be encountered with increasing frequency:

I can say that while the problems confronting controller manufacturers today are both those of production and distribution, the chief problem is in the production of off-standard devices and combinations that are demanded by our customers. The electrical industry suffers from the fact that the purchasers of electrical equipment have learned to demand what they want and not to take what the manufacturers have to sell. In the industrial control field this means that while as manufacturers we try to evolve standard unit control devices that can be manufactured in quantity and carried in stock in our warehouses, on the other hand some of our most important customer classes are not content to take these units and assemble and connect them for the desired control combination but demand that these be put together at the factory. As a matter of fact, the engineering departments of practically all industrial control manufacturers are so tied up in getting out designs and instructions to their factories on special combinations that they are decidedly handicapped in following out their programs in connection with development standardization.

Product Development

So much for marketing and production problems. Administrative problems seem to be almost as numerous and as varied. The question of development in the face of a multiplicity of local assemblers is perplexing many of the manufacturers. One of them analyzes this question as follows:

The biggest problems that confront the electrical manufacturer of today, I would state without hesitation, are those of development. This may seem a rather unexpected answer to your question. Of course, I have naturally narrowed this answer down to that portion of the electrical industry with which I am connected, namely, panelboards and switchboards. In addition to the several manufacturers who are endeavoring to carry on a more or less nation-wide business in this class of equipment, there are several times as many concerns operating in local territories. Practically every large city has one or more local panelboard and switchboard assemblers. These small concerns buy most of their equipment, assemble it on slate or asbestos panels in the form of panelboards and switchboards. In many cases these small assemblers are furnished parts by the larger companies, and, to a certain extent, therefore, further the sale of a larger nationally advertised manufacturer. These so-called local assemblers operate in a very restricted area and often combine their sales and engineering in one person.

It is right at this point that the problem of development injects itself. The companies with national distribution, employing expensive engineering set-up, are the organizations which are looked to for most of the development, to keep this branch of the electrical industry progressive. But little explanation is necessary to those engaged in such an organization to establish the fact that progressive development costs real money. Were the entire cost of such development applied against only the new product the cost in many cases would be so prohibitive that actual sales would seldom be made.

So it is that most of this expense is tacked onto the cost of whatever equipment is purchased from a panelboard and distribution board manufacturer doing an extensive business. Some will naturally say that a good deal of development is duplicated; that each different concern tries to copy something that a competitor has done very well in.

It is, however, by competition in development that the better product is always evolved. It will be a sad day, when, if ever, competitive conditions should force the progressive manufacturer to take the stand that development in this particular branch of the electrical industry could not be afforded.

One of the savings that could be made by a manufacturer is the elimination of all general engineering and development expense; the elimination of elaborate data books and similar helps that make for "the better job." The elimination of personal engineering assistance to the trade, engineer and architects would, of course, be a very backward step.

The solution of this problem, therefore, as I see it is not to abolish development but to increase our campaign of education to show that the prices asked are fair prices and that the cost of development is a legitimate expense to be passed along in the price of the goods.

What Lies Ahead?

And this manufacturer, as well as a host of others, wants an answer to the question, "Where do we go from here?"

It must be conceded that both manufacturing and distribution problems loom big, are important and vital, but they are simply our everyday problems which can be solved by the exercise of common sense and the good judgment we all, as manufacturers, are supposed to have but frequently neglect to exercise. However, in my opinion, a still bigger problem is to know where we are going. We know where we have been, and while this is interesting, it is not so important as to forecast our future position in the scheme of business. If you can outline a plan to get our eyes off the past and turn a searchlight on the business road ahead—it will be of real service to the industry.

Threat of New Developments

Is this fear justified? It might be interesting to get an expression of opinion from a number of manufacturers, seeking to learn what products are threatened in this way:

One of the problems before the industry today is the general uneasiness which in some quarters is verging on panic, due to the fear of some radical changes in wiring materials and methods, which would disturb the normal flow of business with disastrous results to all concerned. Another condition which has a tendency to choke the free development of our industry is the regrettable practice of certain local groups here and there throughout the country of specializing on one type of wiring materials to the exclusion of all others. This simply means that many prospective installations never materialize because somebody is trying to fit round pegs into square holes.

Chance to Eliminate Waste

"Customer trade associations" is offered as a means to remedy one condition, namely, the production of and effort to sell too many types and sizes and styles of product. This problem, despite the efforts that have been made in recent years to eliminate waste in industry and commerce, does not seem to have been given much attention by the electrical industry:

The elimination from the manufacturers' lines of product of a great many types, styles, ratings, etc., of apparatus built is a big problem. The number of types and styles has grown large because of the conglomerated demand of the market, which character of demand has not contributed economically to the success of the industry as a whole. The manufacturer's position in this connection is extremely difficult on account of inability to obtain mass production in fewer styles rather than smaller production of the many. Problems of stocks, warehousing, etc., etc., are also increased materially. The problem must be approached through *customer* trade associations. Just how to accomplish the results is a matter of daily concern with no possibility of fixing a procedure with assurance of a solution.

Unintelligent Management

Despite all the achievements of modern business and all the things it has devised to help remove its difficulties, there is still as great a need as ever for common sense and brains to prevent the consequences of unintelligent management. Read this emphasis on the desirability of more and better brain power:

One outstanding problem confronting electrical manufacturers is the effect of the action of the honest manufacturer who doesn't know what he is actually doing. These are the days of combinations, standardization, systematizing, mass production, centralized buying, automatic machinery, budget control, conferences, industry advertising, various bonus encouragements, compensation, workmen's welfare, profit sharing, business and market surveys, new developments and more detailed cost systems, as well as many other grand things not tabulated. Many of these were heralded as some sort of panacea, which might in some way automatically set-up and keep business enterprises running smoothly without the old time "work and worry" and avoid mistakes in adjusting the interests of the stockholders, the employees, the customers, the industry and the public law, which is the real job of a progressive and profitable management.

But the truth still remains that no amount of system or surveys can take the place of brains—that efficiency is a matter of common sense, that advertising is a waste unless wisely used, that standardization and simplification creates new problems and that brains and energy are and will be required to understand and translate into action the prophecies of the forecasters.

In spite of all the tendencies of modern business, there never was a time when real intelligence was so urgently needed, altho modern efficiency is complete and satisfactory. Standards and ethics have advanced so high that the man who forty years ago would have been an outstanding figure in a community is today considered an average. An electrical manufacturer whether large or small, must, to be a successful manufacturer, solve his problems by a balanced adjustment of the several factors represented by the letter "M," representing Management, Men, Money, Materials, Machinery, and the two "M's" turned upside down of Work and Worry.

Substandard Materials

The point of view of many, many manufacturers on the question of substandard materials and appliances is expressed in the following letter:

I consider the biggest problem confronting the electrical manufacturers today is the elimination of substandard materials. When you consider that practically every electrical device carries a cord of some kind or other and that less than 40 per cent of the flexible cord manufactured is underwriters' labeled cord, you will get some idea of how the industry is honeycombed with substandard materials.

Substandard cord is only one item, as there are lots of other unapproved items on the market used to make up electrical products of one kind or another. It is my belief that over 50 per cent of the electrical appliances on the market today are so badly standard as to be a menace both to property and life.

This condition cannot fail to affect the prosperity of the whole electrical industry unless it is corrected. It seems to me that every branch of the industry should get behind a definite program to stamp out substandard materials.

Computing Tomorrow's Costs

How to compute future costs of delivered goods is a difficult question in more than one manufacturing office today. It seems to be troubling a number of the leading executives in the industry, one of whom writes as follows:

The biggest problem of an electrical manufacturer equipped to understand the balanced adjustments and translate the cost figures, the efficiencies, and surveys into profits for himself and the industry is "On what will the future costs of delivered goods be computed?"

For several years production costs have been decreased with reduced direct manufacturing labor. In general there is a smaller number of direct labor workers with each individual worker producing more and being paid more, but on the other hand the factory non-productive salary list, the office salary list and particularly the distributing salary list and labor has increased many fold, while the direct labor was being reduced. This tendency may compel a new basis of computing costs, requiring the present direct labor basis is to be of a secondary nature.

The honest manufacturer who does not know what he is doing at present and fails to check the changing ratio of direct labor costs and the salary costs entering particularly into the distributing end which could and should be done by means of knowledge obtained through the latest cost system, giving the profit on each class and sub-division of the manufactured material presented monthly or quarterly is not in condition to sell all divisions or classes of goods he manufactures at a profit.

The information obtained through national associations with consequent contact with competitors in the joint work should place a manufacturer in a better position to understand intelligently the cost of doing business. Then profitable lines could be determined and the work and worry of ordinary business energies be devoted to producing and distributing only those profitable lines.

A portion of the profit received could then be returned to the industry in the form of developing new conveniences and thus further assist in the general prosperity of the country, whose business success has been based on development translated into profitable industry.

Die Castings for Electrical Products

By Robert M. Curts
Technical Service, New Jersey Zinc Co., New York City

Robert M. Curts

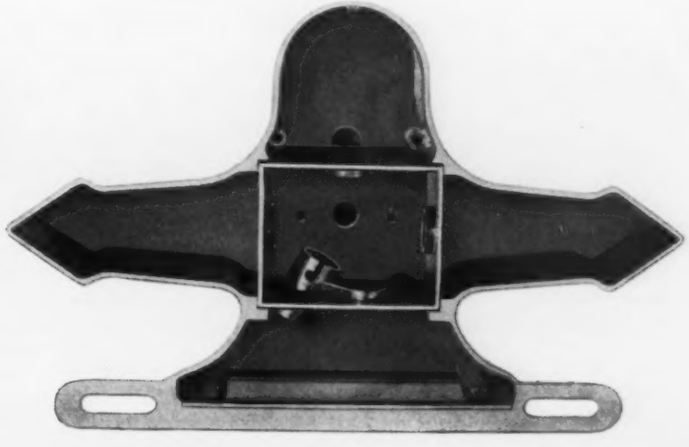
GENERALLY speaking, a die casting is made by casting molten metal into a die, the die being made of such material as will most economically resist cracking, alloying, and solution at the temperature of casting. Special grades of iron and steel are usually employed for this purpose. Hence, in a broad sense, die casting includes the processes of both gravity and pressure casting. As implied by the name, the former method relies on the force of gravity to carry the molten metal into the various cavities of the die, while the latter method employs the application of external pressure, either pneumatic, mechanical, or a combination of both.

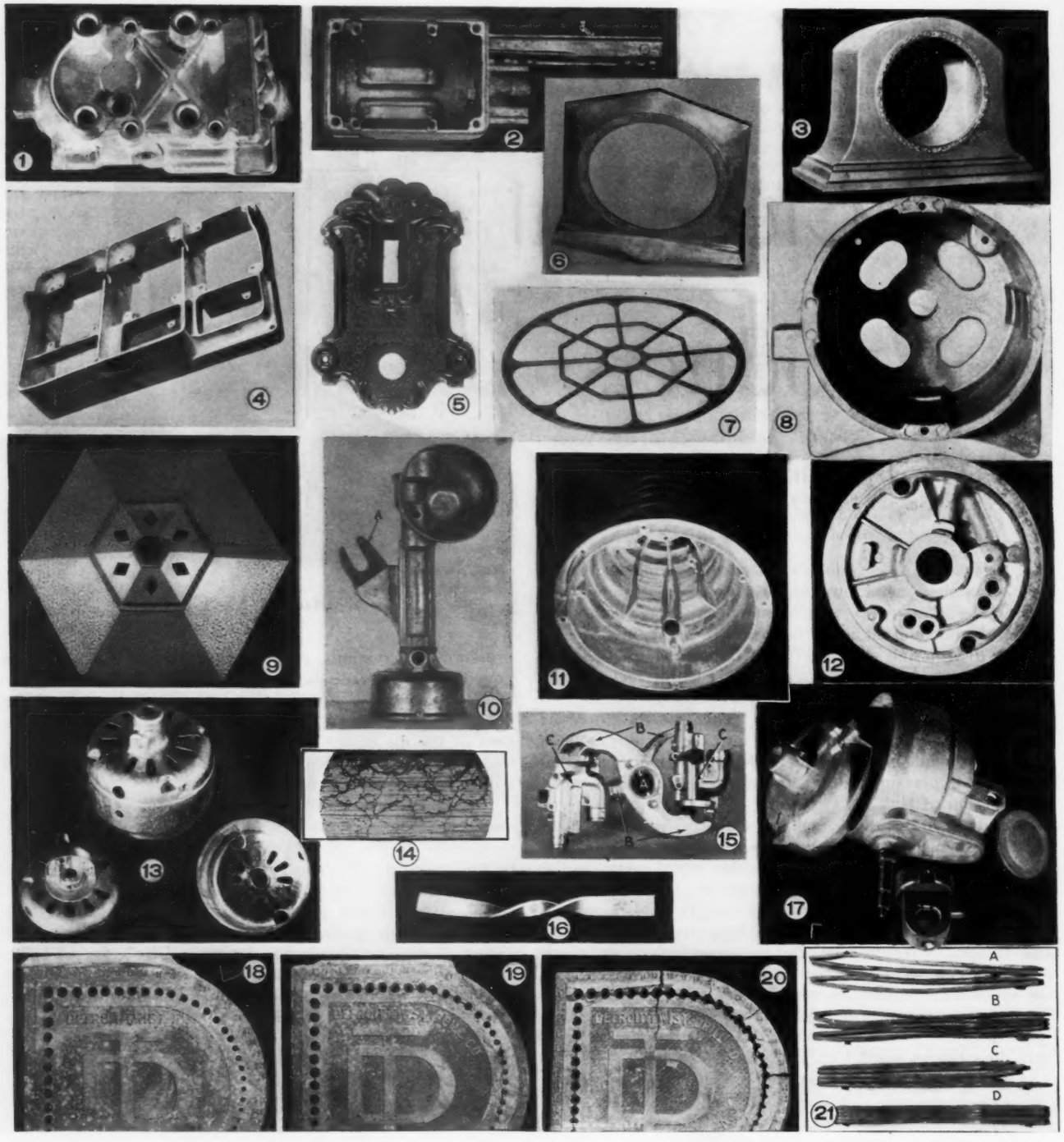
Gravity castings also include slush castings, so-called because when the outer shell of the metal has frozen in the die, the die is inverted and the slushy, liquid metal in the center is poured out, leaving an irregular core. This method of casting is usually performed manually, and, hence, is not suited for quantity production where costs are the essential factor. Pressure die castings are invariably much stronger because of the type of alloys available and due to the speed with which they can be made they are best suited for quantity production. Since this method is the more important, the following discussion will be limited to pressure die castings made with zinc base alloys.

It has been estimated that the production of zinc base pressure die castings consumed well over sixty million pounds of high grade slab zinc in 1928. The recent appearance of many new articles that have not heretofore been made of die castings, together with the apparent willingness of the die caster to make larger and heavier castings than in the past, indicates that the consumption for 1928 will be greatly exceeded in 1929.

If the manufacturer of a commodity employs die castings, and if by so doing he is able to lower his costs, he does not necessarily intrinsically cheapen the finished product. If he has specified the proper alloy, he usually improves the quality of his product through the use of materials that give added strength and greater resistance to oxidation and corrosion. The principal economy afforded to the consumer of die castings is not determined by costs of basic materials that reflect on quality, but results from the ease and rapidity with which the finished casting may be produced. For example, practically all the maching costs are eliminated and by the use of inserts, brass, steel, bronze, babbitt, etc., that are cast in place, finishing and assembly costs are materially reduced.

Figures A and B below show respectively a washing machine motor gear housing weighing 12½ lbs. and an automobile tail lamp housing, weighing 3⅛ lbs. Both are good examples of zinc base die castings





Some Typical Examples of Zinc Base Die Castings

IN THE illustrations shown above are some good examples of typical zinc base die castings that indicate to the electrical manufacturer some of the various forms in which such products are made and how well they lend themselves to applications with electrical devices. No form or shape is too complicated and they are readily adaptable to any modern kind of finish, such as polish or enamel. Included with the group of die castings are some test samples showing the effects of different mixtures for the castings.

1. *A small magneto base showing how it is possible to pre-cast holes and inserts, which in the finished product require but little machine work.* 2. *This is typical of the housing for an automobile windshield wiper.* 3. *A loud speaker housing made of a zinc base die casting that weighs more than 8 pounds.* 4. *Another example of the possibilities in die castings for radio receiver apparatus. This is the chassis casting for a modern type of receiver.* 5. *Radio cabinet hardware is also made from die castings. (Note the ornamental design and the raised letters.)* 6 *and* 7. *These are respectively a radio loud speaker housing and the speaker grill.* 8. *A die cast motor housing.* 9. *The base for an electric "Sun" lamp. It is* 18 *in. wide and weighs* 9 *pounds. (Note the attractive lacquer finish.)* 10. *An automobile distributor housing. The piece marked (A) is a steel insert cast in the metal.* 11. *Another motor housing. (Note the careful design that allows maximum strength with minimum weight—2¼ lbs.)* 12. *A very similar casting to that in* 11, *but it is a generator end bracket.*

13. *Examples of housings for fractional horsepower motors.* 14. *Inter-crystalline oxidation in a die casting, starting at the surface and penetrating to the center.* 15. *Castings removed from a double impression die showing (A) Sprue, (B) Gates and (C) Castings.* 16. *A die casting test bar twisted through* 360 *degrees.* 17. *Housing parts for an electric fan motor.* 18, 19 *and* 20. *Three die castings made of different kinds of metal and exposed under different conditions.* 21. *Tensile bars cast for alloys containing various amounts of tin and exposed for test purposes, showing how the best kinds of materials are found for die casting*

These savings afforded by the use of zinc base die castings have had a very pronounced influence on the manufacturing costs in many of our industries. In the case of the automobile industry, ever on the lookout for new economies,

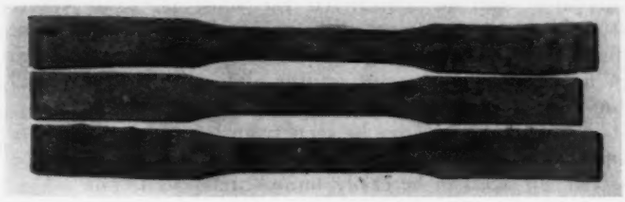


Figure 22

Another example of test bars made of different kinds of metals and exposed to the atmosphere for varying periods of time and under changing conditions, to determine the properties and characteristics of the different test specimens

it has adopted zinc base pressure die castings in the construction of carburetors, fuel pump bodies, steering wheel parts, magneto and generator housings, spark and throttle levers, lamp housings, lamp brackets, windshield wiper housings, both electric and vacuum types, speedometer parts, instrument panels, cowl bars, door handles, robe rail brackets, radiator caps, clock frames, and numerous other parts.

In studying the foregoing list it is at once evident that many of these parts impose rather exacting demands relative to impact and tensile strength, freedom from growth, and resistance to corrosion. Fortunately the high grade alloys now available are able to fulfill these requirements and as a result the automobile industry has become the largest consumer of die castings.

Varieties of castings are also employed in the manufacture of sewing machines, printing press accessories, moving picture machines, washing machines, cash registers, vending machines, check writers, pencil sharpeners, spray guns, etc.

The manufacturer of electrical appliances has likewise employed the use of zinc base die castings and today it is estimated that the electrical and allied industries consume approximately 30 per cent of the total die casting production, ranking second to the automobile manufacturer.

A large variety of radio loud speakers are die cast and subsequently finished by sand blasting and lacquering. The housing of one well-known loud speaker is made of a zinc base die casting, as is shown in Fig. 3. Radio cabinet hardware, such as that in Fig. 5, including indicator drums, an orthophonic loud speaker valve, loud speaker grills, and the entire framework or chassis for the condensers, transformers, etc., are also made of zinc base alloys.

It has taken many years to perfect an alloy that would perform satisfactorily enough to meet the requirements of such parts as the chassis or framework of the radio set. Obviously any appreciable growth of the castings would throw the entire apparatus out of adjustment and, hence, the consumer must be careful to specify only the highest grade of alloy for this purpose.

In connection with the uses of die castings in the automobile industry, mention has been made of distributor housings, electric generator housings and end brackets, electric tail lamp housings and electric windshield wiper housings. One of these windshield wiper housings is shown in Fig. 2.

Die castings are also employed as frames of electric clocks, for telephone rack skeletons, for governor weights in connection with a well-known electric refrigerator and, last but not least, for fractional horsepower motor housings.

One of these housings is illustrated in Fig. 8, while Figs. 11 and 12 show somewhat different types. During the past year the use of die castings in the construction of fractional horsepower motors has become very popular. These housings may be subsequently finished by lacquering, nickel or chrome plating as desired. Fig. 13 shows assembly parts for an electric fan motor, including the motor frame, screw cap to close gear case, end bracket for bearings, and oscillating mechanism. Die castings are also used for motor brush holders, rotors for induction motors and internal fans for cooling the electric motor.

Having learned something of the wide application of die castings, let us now investigate how and of what materials they are made. As previously noted, pressure die castings are made by forcing molten metal into cavities which have been cut into steel dies. Machines employed for such an operation are usually classified as either the plunger type or the air type. In the former, the molten alloy is forced into the die by means of a cast iron plunger which fits tightly within a cast iron cylinder, the exit end of which is sometimes called the gooseneck. During the early evolution of die casting machines, this piston was operated by hand, but is now actuated indirectly by air pressure. The cast iron cylinder is immersed in the alloy pot and when the piston is at the beginning of its stroke, the metal from the pot fills the cylinder by entering a small hole located near the top. When the piston has passed this hole there is no other place for the metal to go, except to the cavities in the die. The mechanism of the machine is such that when the piston begins its downward stroke, the exit end of the gooseneck is pressed against the sprue (entrance to the die).

IN asking for bids all die casting buyers will find that the bids will be more reliable if they will submit as much data about the casting as they can possibly obtain. This should include the application of the part, surface conditions desired, present manufacturing method, material now used and if satisfactory, surface finish required—plated, polished or enameled—and approximate yearly requirements. The quantity to be purchased represents one of the most important factors in the course of die casting. It is more economical to buy for six months or a year than in small quantities.

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The plunger or piston is absent in the air type machine. In this case the gooseneck operates on a trunnion. The greater part of the gooseneck is immersed within the alloy pot. It is filled with molten alloy by allowing the exit nozzle to dip below the surface of the metal in the pot. Then it is brought into position for making the cast by fitting the exit nozzle against the sprue of the die. Automatically the other end fits snugly against an air valve that is released, resulting in a pressure on the head of metal that

Figure 23

The selection of metal has an important bearing on the life of any die casting. That shown above was exposed for five days to an atmosphere saturated with water vapor with very poor results

forces it through the sprue and gates into the die cavities.

Machines vary greatly in the details of their construction but essentially they operate on either one of the two methods outlined. Large machines have been designed to make castings weighing as much as 20 pounds. Where a very large casting is required, two plungers and two goosenecks are employed. Many of the recently built machines are automatic in almost every detail.

A die consists of two halves, one being movable and the other stationary. The metal enters the die through sprue hole and gate. The air is driven from the die through vents. As soon as the metal has solidified, the die is opened and ejector pins—actuated by levers or cams—are pushed toward the center of the cavities, forcing out the casting ahead of them.

The size of the dies that may be used with any machine depends on the size of the machine and the pressure available to force the molten metal into the die cavity. The dies are often equipped with as many as eight and twelve impressions in which case each time a "shot" is made either eight or twelve castings will result. Hence, if the machines were making two shots a minute, the result would be 24 castings a minute. The number of impressions that can be made in a single die depends largely on the size and shape of the casting. The die caster must pay special attention to the proper gating of the dies in order to obtain a uniform, smooth surface at normal casting temperatures. Sometimes he must make several attempts before he obtains the proper arrangement of the gates.

Figure 15 shows two castings that have been removed from a double impression die. A is the sprue, B are the gates, and C are the castings. Each casting has been gated in two places. It is well to point out to the consumer of die castings that the cost of both dies and castings will usually be lower if he is careful not to impose any unnecessarily rigid tolerances. As has been already mentioned, inserts (brass, bronze, iron, babbitt and even porcelain) may be cast in place—forming an integral part of the finished castings. Even die castings themselves can be used as inserts. The shrinkage of the alloy around the inserts is such as to make them very firm.

Zinc base die castings can be polished and plated with nickel, chromium and other metals. They machine very much like free cutting brasses, with small chips that have no tendency to clog up the tools or to impede operation. They can be soldered, although soldering is to be avoided if possible. Very attractive finishes may be obtained by immersion in chemical solutions or by lacquering.

The most important factor relative to the use of zinc base die castings is the selection of an alloy that will fulfill the requirements imposed upon the finished castings. It is unwise and false economy to use cheap alloys or alloys made with inferior grades of raw materials. Practically all the grief connected with failure of die castings to stand up in service may be traced to the use of inferior alloys, this inferiority resulting from either the composition of the alloy itself or from the presence of certain impurities that accelerate aging, expansion and deterioration.

Generally speaking, there are three types of zinc base alloys now being used in zinc base die castings.

1—The tin alloy, containing approximately 6 per cent tin, 0.5 per cent aluminum, and 3 per cent copper. Although this alloy was used to some extent in the past, it has gradually been displaced by the stronger zinc base alloys and today it plays a very insignificant role in die casting.

2—The "4-3" or "5-3" alloys, containing from 4 to 5 per cent aluminum and 3 per cent copper. This alloy has a relatively high tensile and impact strength and is being used today in the production of many castings.

3—The "4-3-.1" alloy containing 4 per cent aluminum, 3 per cent copper and 0.1 per cent magnesium. This is the most recently developed alloy and is rapidly replacing the "4-3" and "5-3" alloys. With an initial tensile strength of 47,000 pounds per square inch, an impact strength averaging about 129 foot pounds per square inch, and a very marked resistance to intercrystalline oxidation and aging, this alloy can be considered the most desirable where strength and long life are the requisite factors. It has done much to promote the employment of zinc base die castings in fields where the manufacturer and consumer were still "on the fence" when they only had the "5-3" or "4-3" alloy. It is very tough, as may be seen from reference to Fig. 16, and it is easily machined. It can be soldered, and with the proper surface can be easily buffed and plated.

In considering alloys, too much emphasis cannot be placed on the importance of keeping the alloy free from impurities, for the inherent quality of the finished die casting is largely affected by foreign matter in the alloy from which it is made.

The most likely impurities to be found in an alloy of the "4-3" or "4-3-.1" type are lead, cadmium, iron and tin. Lead and cadmium occur as impurities in the zinc from which the alloy is made. Tin and iron are usually picked up during the die casting process.

Abnormal amounts of lead and cadmium and even small traces of tin will cause accelerated aging and intercrystalline oxidation. This is especially so when the castings are exposed to warm, moist atmospheres. Varying degrees of intercrystalline oxidation and cracking are shown in Figs. 14, 18, 19, 20, 21, 22, 23, 24.

Intercrystalline oxidation commences at the surface of the casting and proceeds inward between the grain or crystal boundaries. The products of oxidation, requiring more space than the original metal, exert such force that ultimately many fine cracks will appear. Of course, this is accompanied by a considerable drop in tensile strength.

Figure 24

Here is another example of a die casting exposed to the atmosphere saturated with water vapor at 95 deg. C. It, too, like that shown in Figure 23, was found to be made of a very inferior type of metal, causing rapid deterioration and disintegration

If a high grade zinc such as Bertha or Horse-Head is used in the preparation of the alloy, the ultimate consumer will be protected from any such catastrophe as results from excessive amounts of lead and cadmium.

The effect of iron is not as serious as is that of lead, cadmium or tin. An abnormal iron content is quite likely to affect the fluidity of the alloy when being die cast and usually results in surface defects on the finished castings.

Tin is an extremely undesirable impurity. Assuming that the harmful effects of lead and cadmium have been disposed of through the use of Horse-Head or Bertha zinc, failure due to swelling, warping, and cracking is invariably the result of tin contamination, and in order to insure an alloy that will make permanent castings, the alloy should have a tin content of less than 0.005 per cent.

Uniform purity of the zinc is the primary factor. Poor zinc will ruin any alloy whether it be the "4-3," "5-3" or "4-3-.1" type.

The best zinc base die casting alloy today is one containing about 4 per cent aluminum, 3 per cent copper, 0.1 per cent magnesium, and the balance high grade zinc.

Selecting the Bearing to Suit the Job

In the selection of bearings for motors there are certain properties of the three types now in use that should receive careful consideration

By J. L. Brown

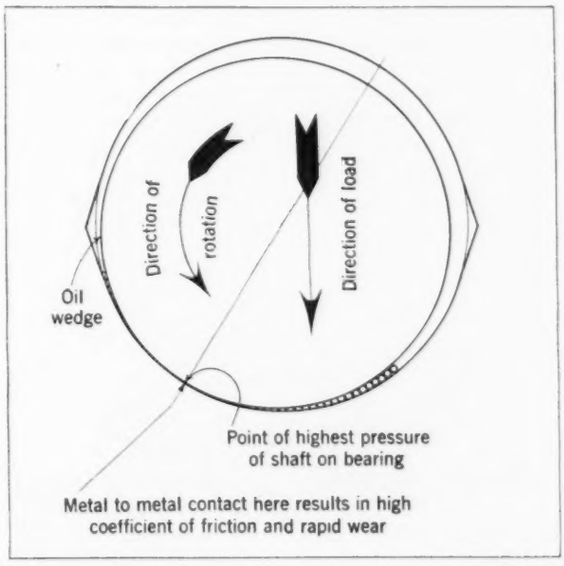
Mechanical Engineer, Westinghouse Electric & Manufacturing Company

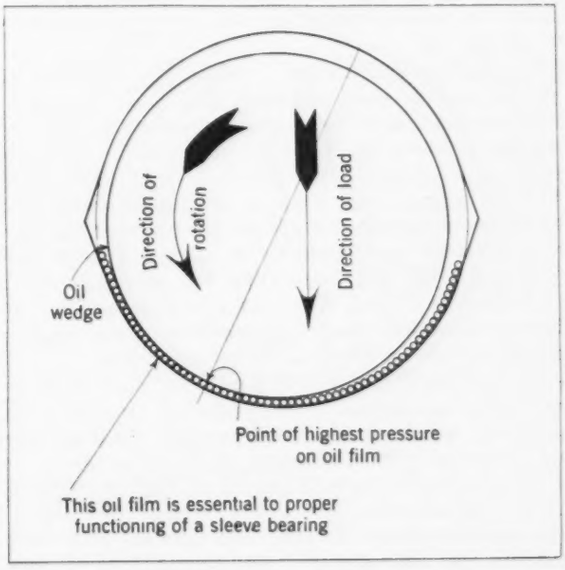
BALL BEARINGS are recommended often as a panacea for all bearing ills. However, it will be admitted by any who have had a variety of experience with all types of bearings that there is no one type of bearing which avoids all disadvantages and embodies the ideal for all applications under all conditions. All types present both advantages and disadvantages.

In order to decide which type of bearing is best suited to any particular application, it is necessary to determine what relation the various advantages and disadvantages the various types have to the requirements of such application. The type having the greatest net aggregate of advantages for the application under consideration may then be chosen. Fortunately, the great bulk of electric motor applications may be satisfactorily served by any one of the ball, roller or sleeve types, provided they are given the limited amount of care and attention essential to their proper functioning. There is, however, a certain range of applications where plain bearings are undoubtedly the only satisfactory solution and, similarly, a range where the advantages of ball or roller types are of prime importance.

It frequently happens that in considering the advantages and disadvantages of the various types of bearings, that the enclosure or housing for the bearing is confused with the bearing itself. Keeping in mind the essential construction of a ball or roller bearing as an inner ring of metal separated by an annular assembly of balls or rollers and that of a sleeve bearing as a simple cylindrical sleeve snugly surrounding the shaft, it will be clear that none of these types provide any self protection against dirt or grit nor embody any means of preventing the escape of lubricant to adjacent parts. Yet, in spite of such self-evident facts, the statement is frequently made that "ball bearings do not leak oil," or that "ball bearings are dust-proof."

Purchasers of motors should insist that the bearings of the motors they buy be protected from dirt, and that adequate provision be made to prevent leakage of lubricant. If such precautions are taken by the motor manufacturer, he will accomplish these results by mounting either sleeve, roller, or ball bearing in an adequate housing. If the housing be adequate, it will matter little what type of


Direction of rotation
Direction of load
Oil wedge
Point of highest pressure of shaft on bearing
Metal to metal contact here results in high coefficient of friction and rapid wear


Direction of rotation
Direction of load
Oil wedge
Point of highest pressure on oil film
This oil film is essential to proper functioning of a sleeve bearing

These two diagrammatic illustrations of conditions often found with sleeve bearings show how essential it is that there be a substantial oil film between the motor shaft and the bearing. Metal to metal contact creates excessive friction and an undue amount of wear, while properly lubricated bearings eliminate this possible source of trouble and unnecessary repairs

bearing is mounted within, as far as dirt and oil leakage are concerned.

Whether in the past such housings as have been furnished with sleeve bearings or ball bearings have been adequate or not is another matter. It is a fact that sleeve bearings particularly, largely because of their almost universal use in years past when bearing problems received much less attention than at present, have not been properly housed in a large percentage of cases, but surely no one will contend that the inadequacy of the housing design is any reflection upon the type of bearing. There have been cases where in ball bearing motors inadequate housing design has resulted in copious loss of lubricant, or infiltration of destructive dirt. Must we, in these cases, change from ball bearings or sleeve bearings or to roller bearings to obtain relief? It must be obvious that a correct housing design will prevent the escape of lubricant and prevent entrance of dirt and is independent of the type of bearing which it may enclose.

From a similar misunderstanding of the situation, it is often argued that greatly reduced maintenance is inherent in ball bearing equipped apparatus as compared with plain bearing equipped machinery. If exclusion of dirt and retention of lubricant are properly cared for by an adequate housing as set forth in the foregoing, the required maintenance will consist of (a) bearing lubrication and (b) bearing replacement or repair.

Three-month periods are usually recommended for regreasing ball bearings and, in many cases, yearly attention is sufficient. However, it has been found that properly housed motor sleeve bearings in eight-hour daily use have required oiling not oftener than once every two years and, in some cases, similar bearings have run nearly four years with a single oiling.

In applications in which the various types of bearings are suitably applied and properly maintained, any type of bearing, whether sleeve, roller, or ball, will last indefinitely. For such ideal performance conservative load ratings must be used, the correct amount and kind of lubricant must be present, and there must be an entire absence of dirt or grit of any kind in the bearing.

Ball bearings particularly are sensitive to abrasive dirt which imbeds itself in the soft metal of the retainer or separator and laps down the diameter of the balls until, in some cases, there is as much as 1/16-in. radial looseness in the bearing. While sleeve bearings will show less distress when subjected to abuse of this nature, it is highly desirable to secure complete exclusion of dirt from any type of bearing.

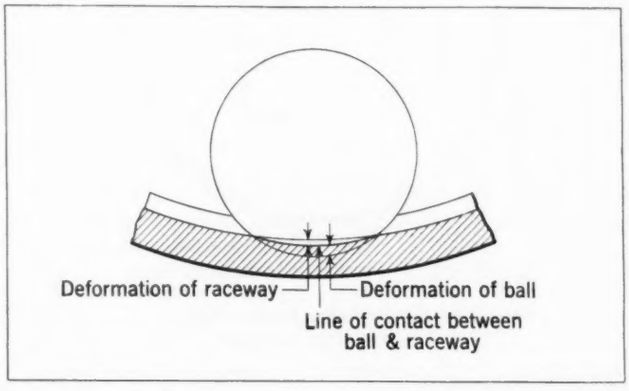
Oil is the most satisfactory lubricant for sleeve bearings. It should be free from sediment; should not precipitate a gummy residue, and for average application at ordinary temperatures above the freezing point of water, should have a viscosity of from 180 to 220 seconds at 40 deg. C. It need not have a high flash point but so-called "light" automobile engine oils which do have a high flash point and incidentally are relatively expensive are, of course, satisfactory. Oil for lubricating ball or roller bearings in addition to having the qualities required for plain bearing lubrication, must be free from even small percentages of acid or alkali as these ingredients will attack and destroy the highly polished steel surfaces of the bearings. For moderate speeds grease is generally more satisfactory for lubricating ball or roller bearings and is more generally used. The grease chosen must be free from acid or alkali and from acid and alkali forming ingredients. It should adhere tenaciously to the polished surfaces of the balls and race-ways. It must not separate into its constituent parts, soap and oil, and should have a uniform consistency over a large temperature range. Roller bearings require a grease of lower viscosity than is satisfactory for ball bearings as gravity must be relied upon to force the grease in among the rollers, whereas balls tend to wind in the grease instead of expelling it from the bearing as is often the case with roller bearings.

One of the chief advantages of grease as a lubricant for ball or roller bearings is the feasibility of preventing its escape from the housing. It must, however, be used intelligently for there are ordinarily no means for preventing overfilling of the housing, especially if a pressure gun is used and grease is forced in until it appears at some point of possible escape, as along the shaft where it emerges from the housing. Such excessive greasing will result in overheating and possible destruction of the bearing. Also, grease will escape from the housing against all preventive means and be thrown onto the motor winding. Additional small quantities of grease at intervals of from three to six months with periodic disassembly of the bearing housing for cleaning out of old grease at intervals of from one to two years is the ideal lubrication treatment for the average ball bearing.

Having discussed briefly the necessity of protection from dirt and grit and the proper kind and amount of lubricant, there remains the subject of conservative load ratings as the third and last factor upon which ideal performance depends. In this connection there is an important and interesting fact which should be borne in mind in regard to the effect of speed upon load-carrying capacity. The capacity of ball and roller bearings is greatest at low speeds and falls off to a fraction of this capacity at high speeds so that for very heavy loads at high speeds ball and roller bearings cannot be successfully applied. On the other hand, the load capacity of plain bearings increases with increase in speed and a further advantage is gained in that, other factors being proportionate, the coefficient of friction diminishes with increase in load.

The proper functioning of a plain bearing depends upon the establishment of an oil film between the journal and the bearing surface. This, in turn, is dependent upon a continuous supply of oil and a minimum velocity for each value of unit pressure. In the case of slow-moving shafts carrying heavy loads, there is not sufficient velocity to establish an oil film, hence, there occurs a metal to metal contact between the journal and bearing surface resulting in a very high coefficient of friction and rapid wear. Such an application is ideal for roller bearings and these have been successfully applied in many such cases.

In choosing ball or roller bearings for a particular application, it must be remembered that there is metal to metal contact between balls or rollers and raceways and that the area of these contacts is quite small, resulting in enormous unit pressure. It is not sufficient to compute the theoretical load on the bearings due simply to the weight of the parts carried or the reaction from delivery of the torque through gears, chains or belts. Various types of drive and con-

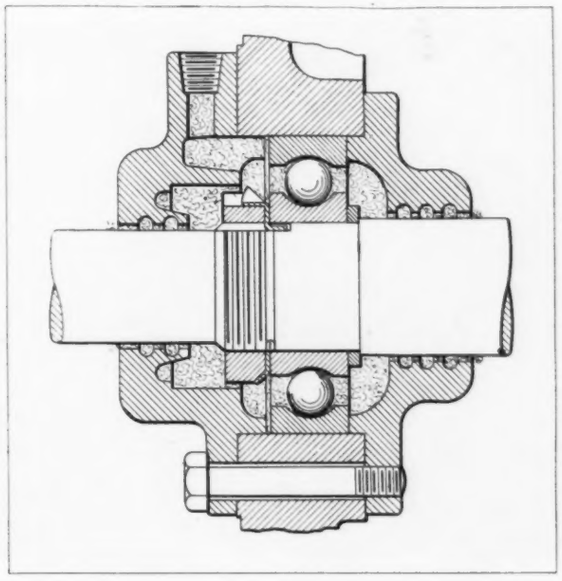


An exaggerated representation of conditions that might arise in the use of ball bearings on motor shafts, showing how the raceway is worn away and the outer surface of the balls is damaged

ditions of alignment and mounting introduce more or less severe vibrations which add to the calculated load and produce high-pressure peaks which cause elastic deformation of the surface metal of the balls and raceways to a degree greatly exceeding that due solely to the calculated load. The stresses produced in this surface metal incident to these severe peak loads, while they may be below the elastic limit of the material are nevertheless sufficient by constant repetition to produce fatigue of the metal with consequent flaking or spalling and complete an early destruction of the bearing.

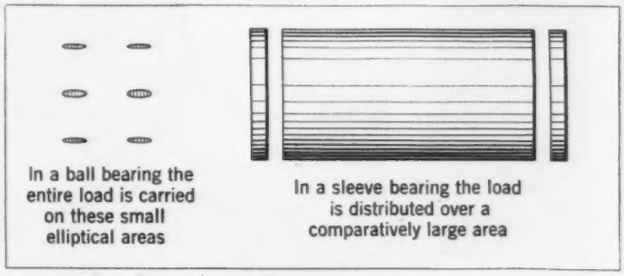
As ball bearings are ordinarily rated in their respective catalogs, a size should be chosen which is rated for a given speed at not less than twice the calculated load for applications where vibration is practically absent. For ordinary industrial drives through belts, chains or gears, a factor of safety of from 3 to 5 should be used. For coupled industrial drives the size bearing necessary for a belted or chained application should be used. Where severe vibration is encountered, factors of safety of as much as from 8 to 10 are necessary. Some types of roller bearings are rated more conservatively and may be used at their rated capacities for average service. For severe service, however, a factor of safety must be used.

Sleeve bearings are usually rated in pounds per square inch projected area, this being the product of the inside diameter and length of the bearing. As before stated, the load capacity varies, depending upon the journal velocity. Furthermore, a maximum permissible loading for any given bearing equipped with simple ring oiling may be greatly increased by the use of lubrication under pressure. Sleeve bearing loads vary from 30 pounds or even less, per square inch to as much as 500 pounds per square inch. The pressure in the pressure zone is not uniform, varying from zero at the edge of the pressure zone to a maximum, in some intermediate position, such that the average pressure corresponds to the average figures given. The journal floats on an oil film which separates the stationary and rotating members. It is highly elastic and acts as a cushion which absorbs shocks, jars and vibration, dampening out noise and protecting the stationary and rotating members of the bearing. It is, therefore, unnecessary with this type of bearing to use such widely varying factors of safety as are necessary with ball and roller bearings which do not have the advantage of the cushioning film.



It has been found in the use of ball bearings that too much lubrication is often detrimental to their efficient performance. This is shown in the illustration above

The chief advantages and disadvantages of the various types of bearings are summed up in the following comparison. It should, however, be borne in mind that all points of advantage or disadvantage are not necessarily pertinent in every application. Hence, the choice of the correct bearing for the particular application being considered becomes a matter of judgment and discretion.


In a ball bearing the entire load is carried on these small elliptical areas
In a sleeve bearing the load is distributed over a comparatively large area

A diagrammatic arrangement showing the comparative distribution of load as between ball and sleeve bearings. Notice that sleeve bearings afford a much larger bearing surface than ball bearings

Advantages of Modern Sleeve Bearings

1—The presence of the highly elastic oil film, cushions shocks and jars due to gear pounding, misalignment, etc., separates metal of shaft from metal of bearing so they do not come into contact; dampens out vibration and noise, provides a measure of insulation between rotor and stator, thus minimizing the effect of stray currents sometimes existing.

2—Globules of oil form the separating medium between shaft and sleeve bearing. They carry away heat from the point of generation. Their surfaces are always perfect. They will not fatigue and spall as will steel balls or rollers. They tend to wash out from the bearing surfaces any particles of foreign substances that may accidentally have gained access.

3—A sleeve bearing is not sensitive to imperfections of the bearing surface. A good mechanic can, therefore, produce a very fair bearing, sufficiently good at least to tide over an emergency and avoid expensive shutdown if no factory-made bearing is available as a spare.

4—Replacement sleeve bearings are relatively inexpensive, which reduces spare part investment. Also, with a limited supply of babbitt and simple tool, old bearing shells may be rebabbitted, thus avoiding investment in replacement bearings.

5—Sleeve bearing housings are relatively long and small in diameter, thus offering a minimum of restriction to ventilation.

Disadvantages of Ball and Roller Bearings

1—Ball and roller bearings have metal to metal contact of balls or rollers and raceways, and therefore do not have the advantage of an oil film separating the several parts of the bearing.

2—The separating medium between inner and outer races in anti-friction bearings are balls or rollers. These cannot escape from the bearing for cooling. Their surfaces must be perfect and depend upon manufacture for their perfection. They are subject to fatigue and spalling. Not only do they not tend to wash out grit and dirt, but their retainers tend to retain dirt also.

3—The slightest imperfections of the rolling surfaces in ball or roller bearings will cause early failure. A factory-made bearing is always necessary as a replacement. An ordinary mechanic, therefore, cannot make even a temporary replacement bearing. This may cause expensive shutdowns if spare bearing is not available.

4—Replacement ball and roller bearings are relatively expensive, and complete sets of spares should be carried in stock by customers, which may make a rather large investment.

5—On account of their proportions, ball bearings and their housings often impose considerable restriction on the ventilation.

(Continued on page 69)

Accurate in Radio Production

Every facility in the way of instruments, tools and special gages are provided in the Kolster plant to insure absolute accuracy

By WILLIAM M. WALLACE

THE story of Kolster radio actually begins at Palo Alto, Cal., for it is there that Dr. F. A. Kolster, with a staff of trained engineers plans the design of Kolster receivers, incorporating such new and improved ideas and principles as would tend to improve the product. Once the design has been determined manufacture of Kolster products takes place in four modern factories, in Newark, N. J., that are fully equipped with every needed manufacturing and shipping facility.

Raw materials—specially treated iron, wire, insulating materials, aluminum, brass—dozens of different items—pour into the factories from freight cars on private sidings. Completed receivers emerge—and the story is not one of manufacture alone—but rather one of a continuous series of tests and inspections.

Every different type or kind of material entering into a Kolster product receives first what may be termed a life test. This is really a test to determine the quality of the general material under varying climatic or operating conditions. It brings out any inherent defects in the material and determines what its average term of use could be under normal conditions. In other words, the life test determines from every angle the fitness of the material for the application and service for which it is intended.

Once a material has been found satisfactory its source is carefully investigated. This applies to the manufacturer of the material, his ability to supply it as it is needed and his fitness to provide a uniform product without any deviation in quality. To insure that new materials will meet these exacting qualifications they are purchased from very strict specifications.

Inspection and test does not stop at this point, however, for one out of approximately every four operators in the Kolster factories is an inspector. Every piece of raw material receives a most thorough test and inspection upon arrival at the different plants.

Having passed the incoming inspection, raw materials then pass into the factory production lines, where enormous presses stamp out such parts as coil shields and condenser plates; lathes and screw machines produce shafts, screws and the like, while many other machines of various types turn out other receiver parts. All through this vast ar-

In the upper corner of this page is an inspector checking the performance of a group of coils while the men immediately above are inspecting the finished receivers. This is the final test of the receiver and these men are actually listening as the sets are tuned in on broadcasting stations

Inspection Essential

rangement of manufacturing equipment carefully made dies and special tools, exact to microscopic limits, make every piece identical with every other such part. And, to insure that they do, inspectors are constantly at work in the production departments checking, measuring and testing every piece.

Here, it might be well to point out that the inspection of raw materials has not been forgotten, even after the material is in the process of manufacture. Samples are continually being taken from finished stock parts and the materials from which they are made must again undergo the closest scrutiny, as was done when it arrived at the factories. This is an operation intended primarily to insure uniform quality in every piece and to determine that no faulty or defective materials are slipping through the manufacturing lines into the finished product. Moreover, this second test serves as a valuable check on the accuracy and completeness of the first incoming inspection.

From the production departments the finished parts pass to the long assembly lines. Most of the pieces are united first as sub-assemblies. As for example, laminations of power and audio transformers are put together; condensers of the different types used are built-up; radio frequency coils are wound on special machines, and in doing all these things ingenious jigs and other special devices are employed to expedite the assembling of the various radio receiver units.

Every operator has his work carefully planned for him, and he performs but one operation on each receiver. As his work is completed, no matter what his task might be, there is an inspector to see that it is done c o r r e c t l y. This applies throughout both the sub-assembly and final assembly departments.

As the various units or sub-assemblies are completed and have passed the requirements of the inspections and tests they pass to the final assembly lines, where they are united with the chassis. The same rigid inspections and tests are carried out in this department and to insure uniformity of product occasional finished receivers are removed from the final assembly lines, for comparative inspections by the engineering department.

After the chassis is complete it is placed in its proper cabinet and this

(*Continued on page 70*)

At the top of this page is one of the most important departments of the Kolster factories in Newark. It is a section of the research laboratories where much of Kolster's engineering work is performed. Above is a section of the department in which sets are checked for amplification gain

Appliances

From time to time ELECTRICAL MANUFACTURING *publishes articles having to do with foreign markets, and this, the concluding installment of an article having to do with conditions in France, outlines the demand for nearly all manner of electrical devices*

BY DOROTHY DIGNAM
*Special European Correspondent**

PERHAPS after all, however, the laundry won't be electrified in France as quickly as the kitchen. The central station in Paris is out to build load by installing appliances with a high-wattage heating element. Electric ovens mean more on their lines than electric washers.

It has not been the practice here for generating companies to merchandise. Electrical stores, household equipment shops and the electrical sections in the department stores have been the sole avenues of retail sale for electrical appliances. But the C.P.D.E. of Paris (Compagnie Parisienne de Distribution d'Electricité) is taking the first step toward what may develop into a merchandising policy by renting electric ovens to their customers.

The logical question to ask is what place can there be for a separate electric oven of 1000 watts in a kitchen already equipped with a gas range — as most Paris kitchens are equipped? And the answer is that gas ranges here are sectional affairs—a hotplate of two to four burners standing on a table and perhaps a small portable oven to place over the burners when there's baking to be done. But mostly there isn't any baking done because bread and cake are bought outside and it's such a nuisance to fire up the big coal range—which has never entirely disappeared from even the gas-equipped kitchen—just to roast meat or fowl or prepare other foods for the meal.

So the electric oven has a real place in the French kitchen and in offering them for rent the C.P.D.E. is doubtless hoping to gradually electrify all the cooking equipment in their district. The gas company serving Paris is already renting hotplates, ovens and cabinet gas ranges such as we have in America.

One month's free trial may be had on the C.P.D.E. ovens and after that the monthly rental is only three to five francs (less than 20 cents in any case). The oven is attached to a separate meter, of course, and on this extra-meter installation hangs the hope of all electrical development in the households of Paris!

Everybody in the city complains about the cost of electricity. The words and chorus of this popular complaint are as well known as the Marseillaise. The Parisian frets about his electric bill like the Londoner frets about foggy weather and until people here get it out of their minds that electricity costs too much for anything more than the bare dispelling of darkness, the market for appliances in this rich district is very restricted. What the C.P.D.E. is doing, therefore, to encourage double meter installations and thus reduce the cost of current is very important to you, as a prospective exporter to France.

The present lighting rate in Paris is about six cents a kilowatt hour. Not expensive according to American standards, of course, but everything in Paris is supposed to be cheaper than anything in the United States—a very

"Dealers Want Washers,"

says Thomas Butts, United States Trade Commissioner in the Commercial Attachés Office, in Paris. He continues, "Tell your people that at least thirty-five French dealers have written to me personally about getting the agency for American electric washers. There appears to be especial interest in washers right now. American manufacturers are urged to write to this office if they want to get in touch with dealers in France"

*This is the concluding installment of an article having to do with the demand for electrical appliances and other devices in France, which was begun in the April issue of ELECTRICAL MANUFACTURING.—THE EDITOR.

jolly little supposition until you come over here and try to live on half your usual income! This six-cent lighting rate slides down to a little below five cents when a number of appliances are used all on the one meter.

The second meter, to which the C.P.D.E. pins its hopes is for power only—not for lighting—and during off-peak hours the rate for electricity goes down to as low as a quarter of a cent per kilowatt hour. The off-peak hours are during the two-hour noon period and after six o'clock at night when factory motors are shut off. Happily, these are just the hours when meals are to be cooked and water heated, so that by using two meters—one for lighting at the regular rate and one for power at the reduced rate, electricity can be employed quite reasonably in the Paris district. But, alas, how few persons seem to grasp the idea!

The C.P.D.E. is naturally predisposed to the sale of French-made electric ware and it is true that French manufacturers are already making such appliances as there seems to be any demand for. Also, the French manufacturer has the advantage in the cost of production due to a lower wage scale and escapes all the added expense of export packing and shipping duty, etc. On standardized items; however, such as American factories can turn out by the thousands at a comparatively low unit cost, the retail price in Paris is not greatly above that of a French-made article of similar class. Some American-made electric refrigerators, for instance, with all the additions of duty and shipping charges are sold at a lower figure here than obscure French-made machines.

A printed list of the duty charged on various electrical items may be had from Washington, of course, but it might be helpful to state some of the particulars in a general way. On appliances shipped complete and entire, duty is charged at the rate which applies to that part of the machine carrying the highest tariff. In most electrical appliances that part is the motor.

Some manufacturers, therefore, ship over their machinery and have the motors purchased locally and put into place over here. Other firms ship the entire product "knocked down," pay the duty on each taxable part separately and have the article reassembled in France. This makes the total duty-charge much more reasonable.

¶ Double metering installations are being resorted to in French homes to encourage the greater use of power. By doing this the French housewife is assured a much lower rate for current during off-peak hours

IT may surprise American manufacturers to know that Belgium and Germany have been foremost in shipping cooking and heating appliances into France within the past few years. American imports have been negligible.

France herself, in the meantime, has not only supplied her own demands but has exported, in 1928 alone, over twelve thousand tons of such appliances. American manufacturers know that they have German competition to meet everywhere in Europe today, but there is no gainsaying the fact that American electrical appliances have a good name with the dealer. And then, too, American firms have the money to back their foreign dealers with good sales promotion. This is most necessary and important! French dealers expect an advertising allotment with the first shipment of goods.

¶ The present lighting rate in Paris is about six cents per kilowatt hour, which is not excessive according to American standards, but everything in Paris is supposed to be cheaper than things in this country

NEWSPAPER space is not unduly expensive, however. There are four Paris newspapers that also cover the whole of the provinces, besides small local papers. Household magazines are quite unpretentious but those like "Mon Chez moi," which has the backing of the housewives' league, may be used with advantage.

Fairs and exhibitions are growing in popularity and constitute a good means of demonstration. Poster display advertising is highly developed in Europe but so popular in France that good locations are hard to get. Window display material, however, is totally lacking, among electrical dealers at any rate. An American manufacturer coming into this territory could arouse more interest by bringing a window trimmer over with him than almost any effort of similar extent. The window is the place for displaying and demonstrating. People must be taught by being shown.

Door-to-door representatives are working successfully for a number of French concerns. The crews consist of two sections—the advance section usually made up of women whose business it is to get past the servant, gain an audience with the mistress of the house and arrange for a demonstration if possible. The second part of the crew, consisting of salesmen, then follow up these leads.

"Yes, French Central Stations Will Merchandise,"

says M. Louis Sartre, chief of subscribers' service, Compagnie Parisienne de Distribution d'Electricité: "We received with much interest the announcement that the New York Edison Company is to merchandise appliances. The central stations of France are working toward that goal. We want to place more appliances in use and we are already creating a wider demand for them through advertising, exhibitions, the hiring or renting of the more expensive devices, but this is just a beginning"

I know you'll want some information on building projects over here and the kind of electrical installation that they involve. In Paris, old buildings are coming down on every corner to make room for de luxe apartments. In fact, so many "tenements" have been swept away that there has been some popular outcry about the homes of the poor . . . where are these people to live if all old buildings are to be replaced by those of magnificence and luxury?

These new apartments, as I have mentioned, are equipped with electric refrigeration, electric ventilation, some with electric ranges and all with the newest type of lighting equipment. There is no lack of convenience outlets in any modern apartment in Paris, but they're all in use for lamps at the present time. Paris will be artistic at any cost! Convenience is quite secondary.

Building projects for the middle classes are all going on outside the city, in nearby suburbs and in the smaller towns. One of the newest projects calls for the erection of 200,000 apartments and 50,000 dwellings. State and municipal aid will be given to this ambitious program and the homes will be modern if not luxurious.

There has been some murmur among the working class that recently erected model-homes have been too pretentious in the matter of gas and electrical equipment for the family

income to maintain. It is possible, if this complaint is well-founded and taken seriously by the authorities, that future building of this kind may be quite simple as to electrical installations, and the material purchased is almost sure to be of French manufacture.

¶ Water power in France is cheap, abundant and available to the masses as never before. Before the war only 13 per cent of the rural communities were electrified, while today some 53 per cent are electrified

THE American market is more likely to be found in the better type of building construction, entirely financed by private means, and appealing to a class of prospective tenants who would be impressed by the name of the American-made equipment in the apartment offered to them for lease or purchase. The cooperative plan of ownership, by the way, is making considerable headway in Paris.

In the older apartments here nothing is furnished in the way of electrical apparatus except the wires in the walls. Even switches, pushbuttons, convenience outlet plates and of course lamp bulbs must be provided by the tenants. The electrical sections in the department stores are completely equipped with wiring materials and one sees an especially large assortment of small supplies such as porcelain switch plates in fancy colors to match woodwork or wall paper.

Lamp bulbs are sold in small shops or depots that carry only this one commodity. Prices begin at about twenty-five cents for a 60-watt lamp, which is standard for household use. All the new finishes and shapes are displayed in about three internationally known makes. Portable lamps cover a wide range all the way from the worst taste I have ever seen displayed anywhere, through the modernistic to the more mild-istic, and finally include those works of art with flounced taffeta shades and rose velvet bandings that only the grace and artistry of Paris can produce!

"Interest in Household Appliances Is Steadily Growing,"

says Melle Paulette Bernege, national president of the Ligne de l'Organisation Menagere (French housewives' society). "We now have branches of the league in all provinces in France, in addition to a large society in Paris, and their chief topic of interest is household organization and equipment. Servants are increasingly difficult to obtain and women must learn how to help themselves, by the use of labor saving appliances"

But Paris we must leave, in these final paragraphs, because I have much news to bring you from other parts of France. The first electrical survey of the whole of the country is just now in preparation by the commercial attaché's office in Paris. This authority divides the whole of France into eleven districts with a prominent city as the trade center of each district. Paris is, of course, the principal trade center of the north and next in importance comes Marseilles, the great port of France on the Mediterranean.

Between these two extremes of the north and the south lies a vast agricultural district and here in these rural sections dwell that 80 per cent of the French population who still live on a low, primitive scale.

The French peasant of today is not the fuedal subject of an overlord, of course, but he certainly has nothing in common with the independent, Ford-owning farmer of America! These simple people who work in the fields, bake their bread on the hearth, wash their clothes in the stream—or in the small villages, turn their homes into miniature workshops for all sorts of light manufacturing—could surely offer no market to the American exporter of electrical appliances.

And yet here, in the heart of rural France, a buying public is being developed, that the electrical manufacturers of the entire world may vie to capture!

Water-power is cheap, abundant and available to the masses as never before—is singing across the country today in thousands of kilometers of brand new high tension lines! The development of water-power in France is to me one of the most absorbing chapters in the whole of French history. Talk about glory and gain under the Grand Monarch! Talk about progress and prosperity under the incomparable Napoleon! Listen to what France has accomplished in this one line of endeavor during the past fifteen years!

Before the war, only 13 per cent of the communities were electrified. Today 53 per cent are electrified and 30 per cent of all the homes in the nation have electric light. France has today over 170,000 kilometers of transmission lines and 6000 kilometers of high tension lines. And remember that all this development has been carried on under the most difficult after-war conditions with all its inevitable money-stringency, loss of engineering manpower, and general economic upheavel.

Since the stabilizing of the franc, the one idea of the present government in France has been to expand the country industrially. The Minister of Public Works believes that an abundant supply of cheap hydro-electric power will not only help to accomplish this aim, but also to raise the standard of living in country districts.

Taxes, therefore, have been reduced and the granting of concessions to private companies speeded up through the Government departments so that more generating and distributing enterprises will be organized. Seventeen new grants have just been issued, and all this expansion will be financed by French capital. A few years ago the electrical program of France was being financed by America, Holland and Switzerland, at interest rates of 11 and 12 per cent.

Today, with the stabilized franc and the general rise in prosperity, French capital is forthcoming as fast as the opportunity for investment is presented. And German reparations taken out in materials instead of gold are being turned into the erection of power plants and transmission lines and the building of generating machinery. In addition to this vast source of supply, French manufactures are said to be taxed to capacity to turn out sufficient power plant and distributing equipment.

¶ The American manufacturer who can bring over a good product for which there is any place in the scheme of French living, put some money behind it and some patience behind that, will profit from his venture

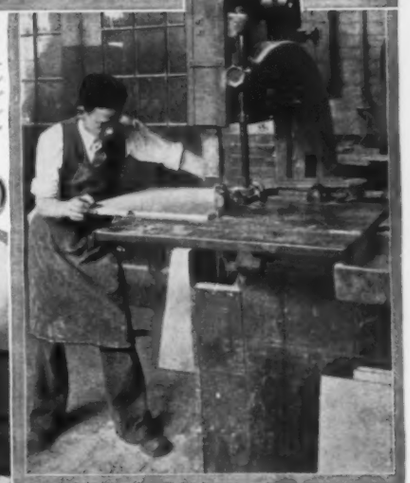
TO understand how and where this hydro-electric expansion is taking place imagine yourself standing with your back turned to Paris, facing the south of France. Behind you, north of Paris, is the coal mining region where there will probably always be steam-generated electrical power because the slack coal and inferior grades are used for this purpose. To your left, is another industrial dis-

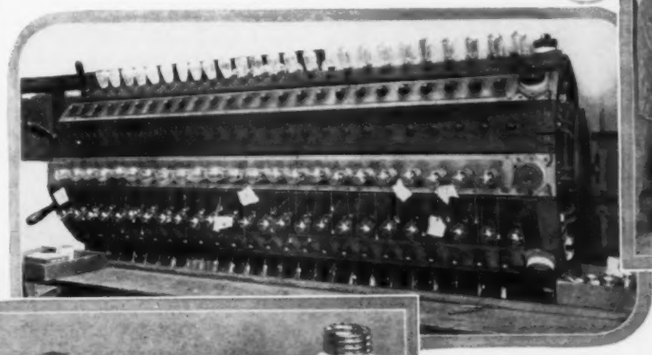
(*Continued on page* 69)

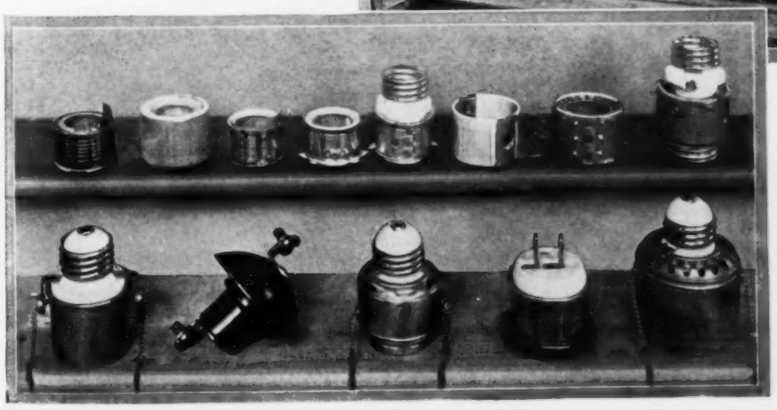
Making Resistance Devices

THE present Wirt Company was founded by the late Charles Wirt, inventor of many well-known lighting appliances, rheostats, insulating joints, resistors and other similar devices. For many years Charles Wirt was associated with Thomas A. Edison, in experimental work at the laboratory in Orange, N. J. The present plant of the Wirt Company occupies two floors of a practically new and modern industrial building in which the principal product of the company is manufactured. Among the various devices now being made are Dim-A-Lites, lightning arresters for radio receivers and another device employed as a current limiting feature in radio receiver power supply circuits. Practically all of these products are manufactured from stampings so that punch presses and similar machines play an important part in the Wirt Company plant

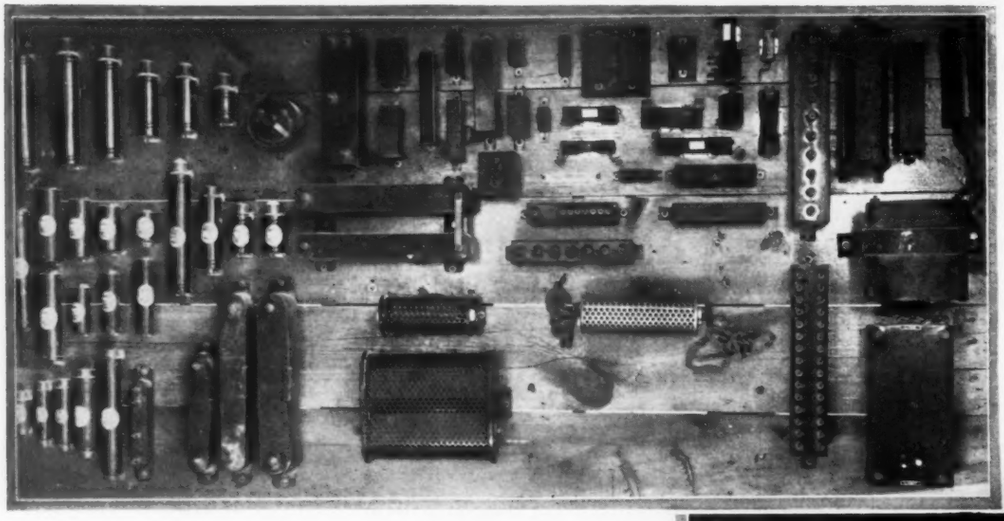
THIS modern factory and office building of the Wirt Company, at 5221 Greene Street, Philadelphia, is adequately equipped with all of the many different types of machinery necessary for manufacturing resistance devices and other products of the company. At the right and above is a view in one of the coil winding departments of the plant. All of the machines are of special design and may be used for winding almost any type of coil. The workman at the right is sawing slabs of insulating material for use in making resistances. Immediately below is a test rack for testing of Dim-A-Lites, the principal product of the Wirt Company. It is essentially a revolving drum in which are fitted rows of ordinary electric light sockets. The Dim-A-Lites are placed in these sockets and inspected before they are shipped. In the case of other products these too receive very careful tests before they are packed for shipment





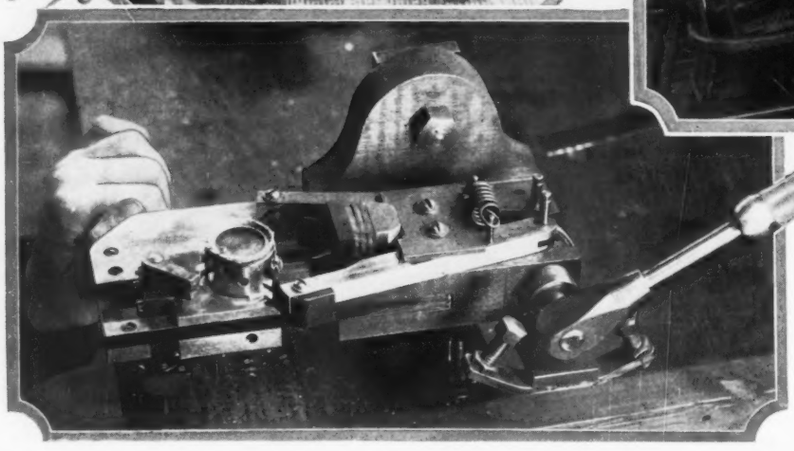


THE various stages of producing Dim-A-Lites may be seen in the illustration at the left. The upper row shows the different types of coils and other parts of the device, while the three principal finished products are shown in the bottom row. Second from the left is a lightning arrester for use with radio apparatus, while the second object from the right of the illustration is another type of resistance that is inserted in power supply circuits of radio receivers



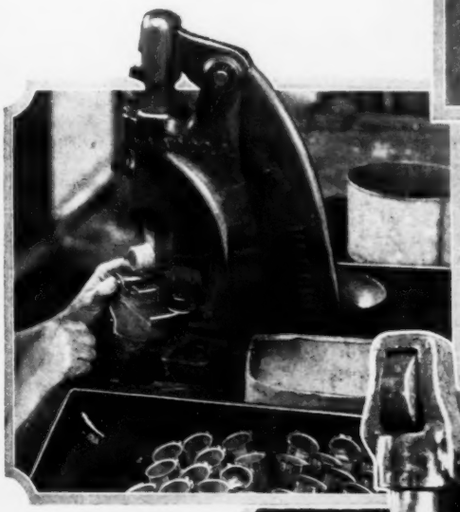
A SPECIAL coil winding machine employed for winding Dim-A-Lite coils is shown below. Resistance wire is wound on a straight piece of insulating material which is afterward bent into a circular band for encasing in the base. The machine is motor driven and is controlled by a foot pedal

THE illustration above shows that Dim-A-Lites are not the only products of the Wirt Company. Here are shown resistances of many different types and for many different applications. They are all products of the Wirt Company and are largely built to exacting specifications. Practically all of the insulating materials used in the production of Wirt products is known as Di-El-Ite. This is used in a semi-liquid state to encase the coils in Dim-A-Lites. To insure that these coils are entirely encased in Di-El-Ite a special machine is used to pack the insulating material around the resistance coils. The operator shown below is pouring Di-El-Ite into troughs from which it passes into the Dim-A-Lite coils

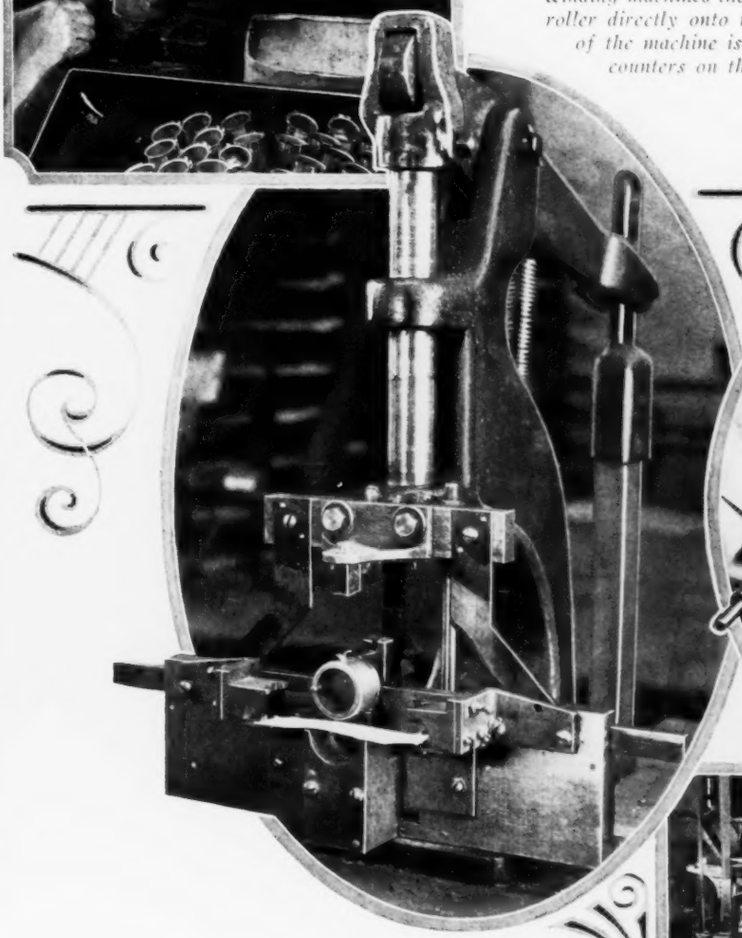


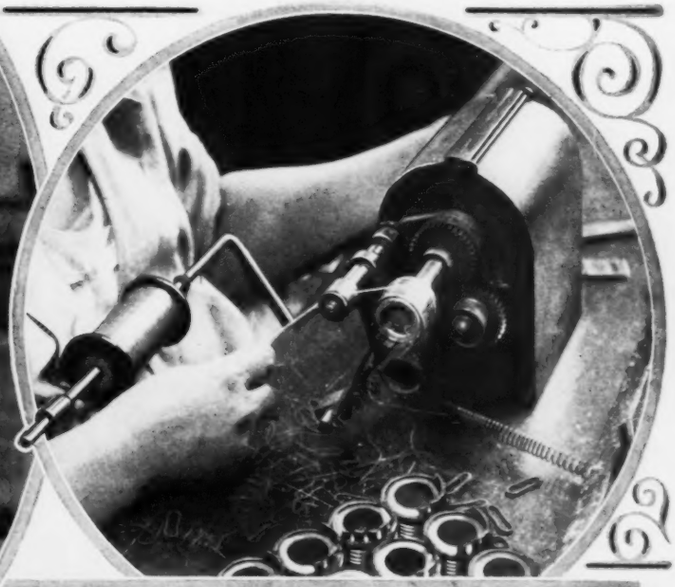
THE Wirt Company packs Dim-A-Lites for shipment on decorated cards, as is shown above. At the left is another of the many home-made mechanisms employed in the production of Dim-A-Lites. It is used for attaching a shielding strip of metal and insulation around the outside of Dim-A-Lite coils

METAL stampings are important in the manufacturing of Wirt Company products and these are made in the department shown at the right. Directly below is another type of special device that is used in assembling Dim-A-Lite resistance coils. It operates like a small punch press and is controlled by a foot pedal. All of these special machines were designed and constructed in the modern tool department of the Wirt Company



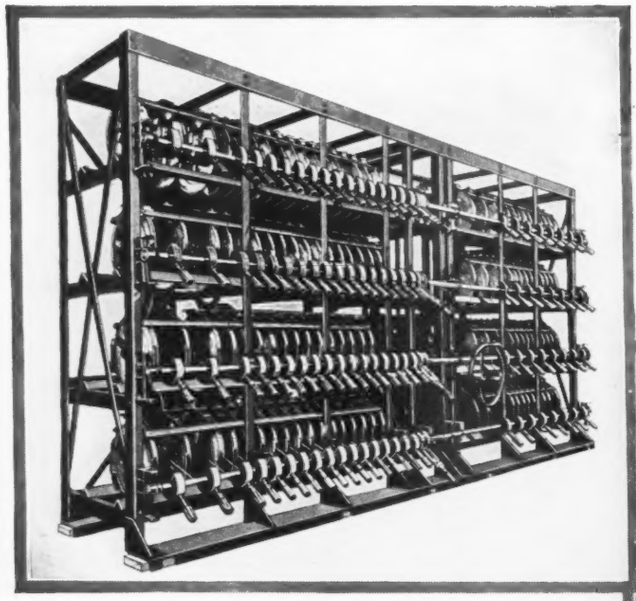
THE Wirt Company manufactures Dim-A-Lites in three different types. For this reason special machines are required for winding each of the various kinds of coils required. In the illustration below, the operator is winding a resistance coil for one of the older types. In this type of coil the different stages of dimming were controlled by separate resistances, while in the more recent Dim-A-Lites the dimming is done with a device similar to the ordinary rheostat. In these coil winding machines the resistance wire is fed from a spool over a tension controlling roller directly onto the coil. The tension on the wire is uniform and the speed of the machine is regulated by a motor controlled by a foot pedal. Revolution counters on the machines insure that each coil will have the exact number of turns of wire required



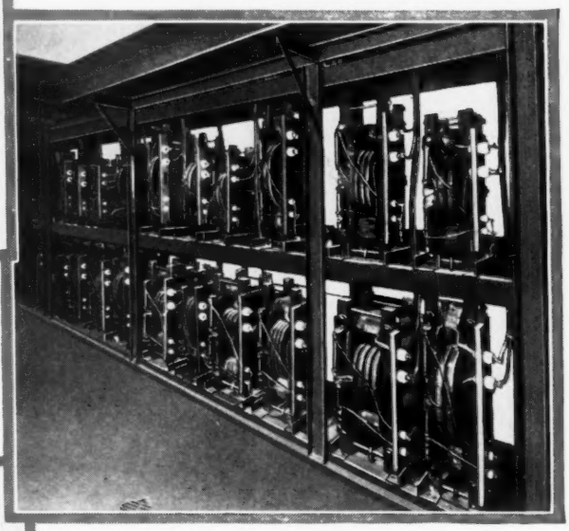


THE Wirt Company manufactures three types of its principal product, the Dim-A-Lite, and the machine above is used for assembling a strip of insulation and its metal casing around one type of coil. It is similar in construction to the other special device shown on this page. At the right is a view in the tool room of the Wirt Company. It is here that all special tools and other equipment for the factory are produced

Throughout the World
VITROHM DIMMERS
for the Accurate Control of Lighting



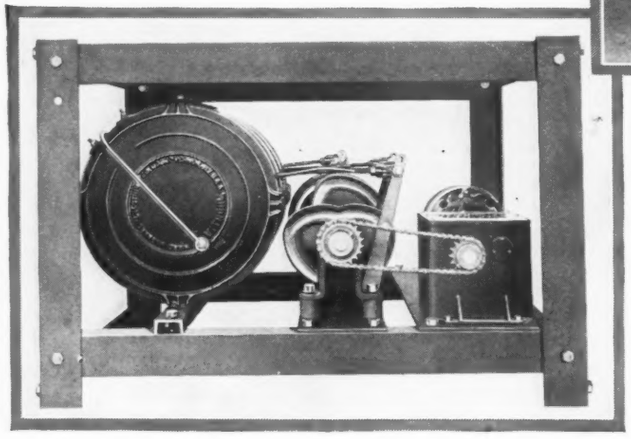
WHEREVER the complete and accurate control of lighting is a paramount consideration, Ward Leonard Vitrohm (vitreous enamelled) Dimmers are specified. The World's Fair at Barcelona this year presents an outdoor lighting spectacle never before equalled. "Vitrohm" was, of course, specified for two huge banks, controlling the entire lighting effects.



(Above) 20 scene pre-set Vitrohm Dimmer Bank for World's Fair at Barcelona.

(Right) One section of main reactor rack in Roxy Theatre, New York, where 750,000 watts of lamp load is controlled by Vitrohm Dimmers.

(Below) Motor driven cycle dimmer for flood lighting, lodge, store and auditorium use.



THE small order receives the same careful attention and service as the largest. Our engineering department is always ready to co-operate in the solution of individual lighting control problems. Write today. Full information on Vitrohm Dimmers to meet your requirements will be sent at once, without charge or obligation.

WARD LEONARD ELECTRIC COMPANY

31 SOUTH STREET, MOUNT VERNON, N. Y.

MEASURING *Instruments* and *METHODS*

No. 5 of a Series on Electrical Testing Instruments and Methods

For testing the torque and brake horsepower of a machine the Prony brake is used extensively, while quick-trip recording instruments are another adjunct in determining equipment operating conditions

By D. H. BRAYMER
Consulting Engineering Editor
ELECTRICAL MANUFACTURING

IN the first four articles of this series several different kinds and types of measuring and testing instruments were discussed, with explanations of their applications in industry. In this article the subjects deal primarily with the Prony brake and with the operating mechanism of quick-trip graphic recording instruments.

The Prony Brake.—For checking torque of a machine and brake horsepower, the Prony brake constructed and used as shown in Figure 5 will give reliable results. This device simply consists of a suitable brake on the surface of a pulley or shaft of a machine with a means for varying the friction produced. The torque developed by the machine to overcome the friction is calculated from the force required to prevent the rotation of the brake. This force is measured at the end of the lever arm in pounds on an ordinary weighing scale. The following formula may be used in designing a suitable brake band for this device.

$W = (Hp. \times 750) \div V$. In this formula W is the width of the brake in inches, V the velocity of the circumference of the pulley or shaft on which the brake is used and Hp., the horsepower to be absorbed by the brake. Since V is equal to $D \times N \times 3.1416$ in which D is the diameter of the pulley or shaft on which the brake is used in feet, and N the r.p.m. of this pulley, this formula may be reduced to the following: $W = (Hp. \times 238) \div (D \times N)$.

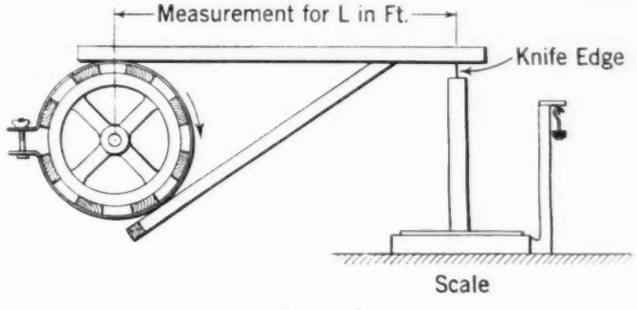


Figure 5

The Prony brake consists essentially of a brake on the surface of a pulley or shaft, with means for varying the friction, and the torque developed is measured at the ends of the lever arm in pounds on an ordinary weighing scale, usually the platform type

In calculating the Hp. or torque by the use of the Prony brake the following formula applies: $Hp. = (2 \times 3.1416 \times L \times P \times N) \div 33{,}000$, in which L is the length of the prony brake lever arm in feet, P, the force in pounds taken from the scales and N, the r.p.m. of the pulley or shaft on which the prony brake is used. This formula may be further simplified as follows:

$Hp. = (L \times P \times r.p.m.) \div 5255$. For calculating the output of an electric motor and expressing the Hp. in the formula in watts, the revised formula would be as follows:

$Watts\ output = (L \times P \times r.p.m.) \div 7.04$.

To determine the efficiency of an electric motor from the results of a Prony brake test, the following formula can be used:

Efficiency = Watts output ÷ Watts input. The watts output is the result from the use of the Prony brake and

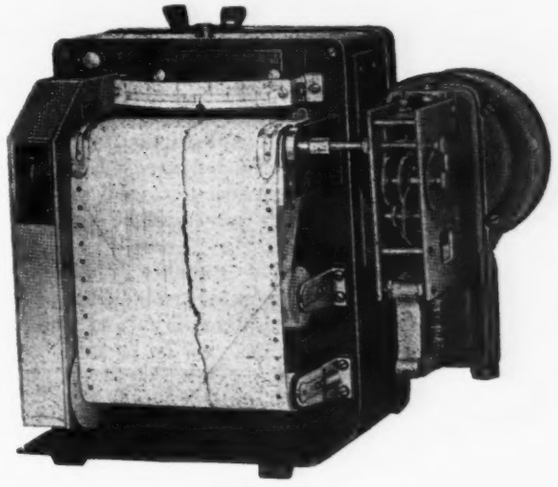


Figure 6

A quick-trip graphic instrument showing the special motor drive for speeding up the chart travel to record unusual conditions. The motor is shown at the right of the instrument with the cover removed

the previous formula, Watts = (L × P × r.p.m.) ÷ 7.04, then,

Efficiency = (L × P × r.p.m.)÷(7.04 × watts input). In this formula the watts input can be obtained from a wattmeter in the motor circuit.

The formula for torque of an electric motor is derived from the Prony brake formula as follows: In the Prony brake formula, Hp. = (2 × 3.1416 × L × P × N) ÷ 33,000, the product of force P in pounds exerted by the brake on the scales times the length of the lever arm L is foot-pounds and equal to the torque exerted. Having found the watts output of the motor under test from this formula for watts, the torque formula can then be expressed as follows:

Torque = (Watts × 7.04) ÷ r.p.m.

When an excessive pressure must be applied to a Prony brake it can be built with an internal rim and water used to reduce the heating. When taking the weight on the scales, the weight of the lever arm must be obtained when the brake is free and subtracted from the total weight recorded as the force on the scales. In applying the load to the brake, the brake strap should be tightened slowly and the friction allowed to become constant before the reading of the scales is taken.

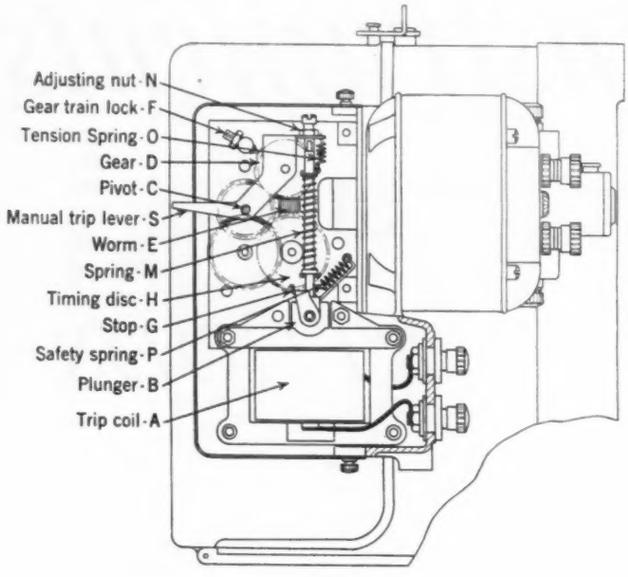


Figure 7

The operating mechanism of the quick-trip graphic instrument shown in Figure 6. This shows more in detail the mechanism used to speed up the chart travel and return it to normal travel automatically

Studying Losses in Production.—There are many manufacturing processes performed by electricity or by machines which are electrically driven wherein a graphic record aids materially in checking the work of different operators, overcoming causes of delay and increasing production. For example, in the manufacture of many kinds of tin containers, it is the practice to spotweld to the lid of the can, a key for opening the container. In one plant where the output of different operators on the same type of machine varied by as much as 50 per cent, a graphic wattmeter was used to study and eliminate the causes.

In this operation the machine is so arranged that the operator places the can top into a holder which forms one electrode of the welder. The key is then laid on the can cover and the other electrode is brought down on the key by foot control to make the weld. The graphic meter showed the wide variations in the wattage for different welds. These variations were due sometimes to variation in the contact resistance between the electrode and the key, and at other times in the switch in the primary of the transformer. Bad contacts tended of course to slow up the work.

The normal rate of consumption for a weld is about 1 kilowatt, but occasionally there would be a surge showing a consumption of from 2.5 to 5 kilowatts. These were found to be caused by improper placing of the key by the operator. When these high consumptions occurred, molten metal was thrown in all directions startling the operator, and delays occurred.

The record, in addition to showing the consumption for each weld, showed the rate at which welds are made by the operator and was of value to the production department in checking up individual operators and overcoming causes of delay.

Quick Trip Graphic Instruments.—Reference was made in the article of the February issue to a special attachment for graphic instruments to automatically change the speed

(*Continued on page 72*)

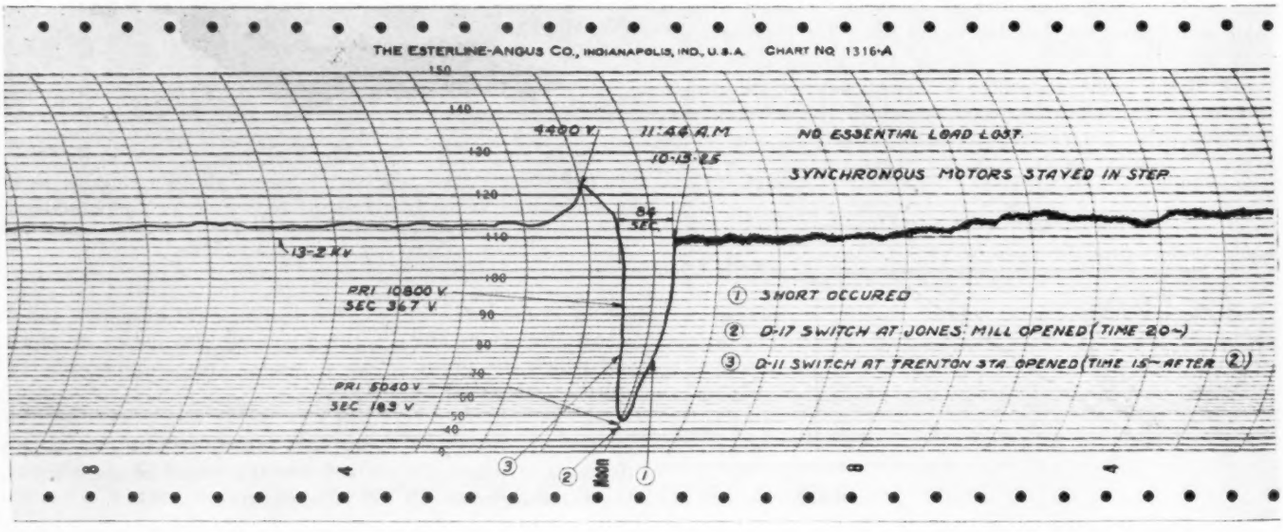

THE ESTERLINE-ANGUS CO., INDIANAPOLIS, IND., U.S.A. CHART NO. 1316-A
4420 V.
11:46 A.M.
10-13-25
NO ESSENTIAL LOAD LOST
SYNCHRONOUS MOTORS STAYED IN STEP
.84 SEC.
13.2 Kv
PRI 10800 V
SEC 367 V
PRI 5040 V
SEC 183 V
① SHORT OCCURED
② D-17 SWITCH AT JONES MILL OPENED (TIME 20~)
③ D-11 SWITCH AT TRENTON STA. OPENED (TIME 15~ AFTER ②)

Figure 8

In plants where interruptions to service are serious, some power companies have installed quick-trip meters to record the effect of such disturbances on the consumer's operations and to give a record of the performance of protective devices. A record from one of these installations is reproduced in the illustration above. In this case the chart shows a short circuit

Fixture Manufacturers and Wholesalers Unite to Reduce Selling Costs

L. L. Reading

By L. L. Reading

Sales Manager, Electrical Department, Franklin Pottery, Lansdale, Pa., and chairman of the Artistic Lighting Equipment Association group selling through wholesalers.

TO create standards of practice, secure economies of distribution, eliminate disadvantageous methods, increase business and bring about a better understanding between wholesalers and fixture manufacturers to their mutual profit—these, in brief, are the objectives of the group of manufacturers selling through wholesalers, organized some time ago within the Artistic Lighting Equipment Association.

That program may appear to be a little pretentious, but it is better to aim high and fall a bit short than to fail to accomplish all that is possible.

That some of the evils in the system of fixture distribution through wholesalers can be overcome is admitted. When manufacturers and wholesalers both learn that modern business is not competition, but cooperation, they will have reached the point where something constructive can be accomplished.

How can we manufacturers help wholesalers to obtain more fixture volume? We believe the wholesaler should maintain a showroom to display a representative line in an up-to-date manner. All fixtures should be marked at full list or selling price, with the dealer selling at that price. Many wholesalers with showrooms do not allow as great a discount to the dealer who sells from sample as to the dealer who carries stock. This is regarded as fair practice and simple justice to the man who invests his money and carries the load.

Standardized Discounts and Terms

OUR group is striving to simplify and standardize practices regarding discounts and terms to wholesalers. At present there are almost as many methods as there are manufacturers. Many manufacturers have different terms to different customers, and no standards as to discounts or time of payment. One of our objectives is to eliminate, so far as possible, such practices. Uniform terms have been recommended.

Another serious problem is the matter of discounts from list prices. Standardization in this matter seems simple, but it does not appear to be so in practice. If standardization could be adopted and used by all manufacturers it would prove to be as much of an improvement as did the adoption of standard time instead of the old system of each city having a different time.

Freight allowance has grown out of intense competition. It is economically unsound and hardly possible of defense. Our group seek to bring all manufacturers to a common ground on this question. We also seek uniformity on how far the manufacturer should go in furnishing advertising to the wholesaler.

Although manufacturers agree that it is their duty to supply pages for the wholesaler's catalog, it is a question whether they should furnish special printing or do any other form of advertising which is the wholesaler's function. If the wholesaler performs his merchandising duty, he is a real factor in distribution. If he does not, then he is a parasite on the general business.

The wholesaler should carry sufficient stock to cover his trade. If he sends orders for direct shipment to customers, he is not performing his function properly and should not expect the same consideration as another who is always ready to serve his customers.

Eliminate Special Salesmen

USE of manufacturers' salesmen to sell the trade for the wholesaler's benefit, particularly by special men who spend almost all their time at it, raises distribution cost to a point where profits disappear, and the greater the volume, the worse is the manufacturer's condition. We seek to discourage and eliminate this practice. Whether our program succeeds does not depend upon the chairman nor the committees working out details for the group, but upon the manufacturers represented. If the manufacturers agree and then in good faith carry out the agreements, very much can be accomplished. If there is lack of cooperation, unwillingness to give a little for the common good, failure is inevitable.

Our first step is to teach the manufacturer that business is cooperation, not competition. We feel that much progress has been made along that line, and we look for real constructive work from this group. We do not expect perfection, we do not believe in ideal conditions, but we do believe that the lighting fixture industry will be materially benefited by the work that is being done.

But, if it is to be benefited all concerned must unite in one common body to assist us in our efforts. There can be no half-way attempt to bring about these suggested changes in the manner of distributing lighting fixtures. Cooperation of all concerned is the only way in which we can hope to achieve even a small measure of the success that is possible. And if that cooperation is not coming, and wholeheartedly, then our efforts have been for naught.

Mica and Its Uses in the Electrical Industry

No. 13 of a Series of Articles on Common Materials

As an insulating material mica is highly valuable in the electrical industry and although somewhat difficult to obtain, it is used extensively

By William Crawford Hirsch

DIELECTRIC strength, resistance to high temperatures, and its mechanical adaptability to electrical uses, together with its attractive average market price, furnish the explanation for mica's prominence among insulating materials almost from the very beginning of the electrical industry. While geologists estimate that four per cent of the world's igneous rock is made up by the mica group of minerals, the supply is not quite as abundant as all that, mica found in flake form in granite and other types of rock being commercially of no value. The mica of commerce is derived from deposits where it occurs in aggregates of sufficient size that are fairly free from blemishes.

New Hampshire and North Carolina furnish the principal domestic production, the mineral being of the commercial variety known as muscovite, some times referred to as potash or white mica. This is also the variety produced in India which country, because of its low labor costs, is today the world's most important producer, supplying a considerable part of the American consumption of both crude and cut mica. Canada has been favored by nature with the most important deposits of the other commercially important variety of mica: phlogopite or amber mica. The latter is not, as many textbooks erroneously state, harder than muscovite; in fact, it is the softness of Canadian amber mica that accounts for much of its use, especially for inter-leaving between the copper segments of commutators where it is highly desirable that copper and mica wear down evenly.

Chemically mica is a silicate of aluminum with part of the aluminum content represented by potash, magnesium or some other element. It is interesting to note in passing that certain mineralogists associate the composition of mica with that of tourmaline which gem-stone, when warmed, develops a charge of positive electricity at one end and a negative charge at the other, the charges being reversed when the tourmaline is cooled. Under certain conditions in the earth's crust, say these mineralogists, tourmaline is altered into mica, a "transmutation" that, because of the pyro-electric properties of tourmaline referred to, furnishes much food for speculation to the scientific mind. Muscovite mica contains approximately 12 per cent potash which serves as a reminder that a good part of the domestic mica production comes as a by-product from the operation of potash feldspar quarries. Because of its obvious impairment of dielectric strength, iron is the principal impurity guarded against.

Aside from this, the physical properties of mica come in for more attention than do its chemical constituents. Mica's outstanding physical characteristic is its basal cleavage. With producers aiming at as close as one-ten-thousandth of an inch precision in the thickness of mica sheets for certain electrical purposes, such as in radio condensers, the splitting quality of mica becomes an all important consideration. Many micas grading high in every other respect are poor splitters, the thin sheets that make up a "book" being difficult to separate and tearing too easily.

Courtesy of Eugene Munsell & Co.

Primitive operations are still used in foreign countries for mining mica, as may be seen from the illustration above. Labor is very cheap and there is little mechanical equipment employed

When mica is to be used in windings, flexibility becomes a paramount consideration. In some of these uses specifications require that a sheet of one-thousandth of an inch thickness must bend into a one-quarter inch cylinder or a sheet of one-hundredth of an inch thickness into a three inch diameter cylinder without cracking.

As for heat resistance, a pure grade of mica will withstand as high as 700 deg. C. Mica stands up well under sudden temperature changes and offers good resistance to decomposition. In certain uses, as for instance in lighting fixture canopies and shades and in instrument diaphragms, transparency is an important consideration. Dark color impairs translucency in uses where light transmission is an objective. While color has no direct bearing on the insulating qualities of mica, it serves as a telltale for the detection of impurities. Breaks in color uniformity, while at times merely surface blemishes resulting from proximity to fat clay and easily split off, frequently conceal iron and other impurities. Specks and stains are the bane of the mica industry. The winning of sheet mica for electrical insulation is chiefly a process of elimination that would be far more costly than it is were it not for the abundance of cheap labor in India, the supremacy of which country as a mica producer may be largely explained as resulting from this condition. Much of the mica, as it comes out of the ground, is so tainted by the adhesion of foreign materials that it is useless even for scrap. Much of it that is sufficiently pure comes in aggregates that fall short of the minimum dimensions necessary to entitle them to the classification of sheet mica.

Requirements for Sheet Mica

THIS designation is reserved for individual pieces large enough to contain a rectangular area measuring at least 1½ by 2 inches, the smallest salable size of so-called "uncut" sheet. To yield this, the crude, irregular-shaped piece, as it comes from the ground, must measure nearly 3 by 4 inches. Sheet mica must be free from "cracks," "rulings," "markings" and reasonably free from specks, stains that do not impair insulation being permissible in some grades. Mica, free from iron, pin holes and cracks, has a disruptive strength ranging up to 100,000 volts per mm. Navy Department specifications call for a dielectric strength of not less than 25,000 volts for each 1/64-in. in thickness. For inter-leaving between the copper segments of commutators and for condensers sheet mica is frequently subjected to tests with the high-tension terminal of a vibrator type ignition coil. Canadian or amber mica sheet is used chiefly for commutators of direct current motors and dynamos, whereas India mica finds use in a great variety of shapes in lamp sockets, fuse sockets, electric heating devices, irons, etc. Aside from its use in condensers in telephone systems, mica forms one end of the carbon transmitter button of the telephone instrument. Mica is also used in high and low tension transformers. For uses in connection with low voltage currents stained grades frequently answer all requirements and a limited amount of impurities is permitted in many electrical uses.

India the Chief Source of Supply

INASMUCH as India is the chief source of the world's mica supply at the present time, it is pertinent to note that the most primitive methods continue to be employed there in the mining as well as in the cutting and splitting of mica. World-wide as is the reputation which India ruby mica has won for itself, production is still along strictly patriarchal lines. What would be the use of labor-saving devices in a country where labor is the cheapest commodity to be had? Pits are still periodically unwatered by bucket brigades of natives, and the mica is passed from the pits by a line of coolie women manning bamboo ladders. Women and children, their thumb-nails specially trained for the task, split the mica. "Madras-trimmed" mica is cut with shears into approximately square pieces, while "India-trimmed" or "sickle-trimmed" is mica that has been closely trimmed with a knife and from which all faults have been removed. In some of the India plants, discs and washers are now being punched, a development that has made the survival of American cutting plants still more of a problem.

Standard price lists of cut electrical mica begin with 1 by 3 inches and run up to 8 by 10 inches. All mica is sold by the pound. The per pound list price of the 8 by 10 inch size is approximately eleven times that of the smallest size which in indicative of the relatively greater scarcity of large than small mica sheets. A mica deposit in southeastern Madagascar is said to yield extraordinarily large sizes without stains or cracks, sheets 25 inches square having been obtained according to reports circulated a few years ago. Next to sheets, splittings comprise the most important classification of mica. These consist of thin flakes split from the smaller sheets or from trimmings, running usually one square inch in surface area, irregular in shape, and about one-thousandth of an inch thick.

Splittings are chiefly used for the manufacture of built-up mica products. A large market has been built up for these products which are made by bonding together the thin laminae of mica splittings by means of resinous binders, principally shellac. The built-up product is subjected to pressure and heat, the latter melting the binder and forming a compact product. The outstanding forms in which manufactured mica is marketed are plates, tubing, washers, bushings, rings and segments as well as disks for static machines and also a large variety of laminated insulation with thin sheets of mica superimposed on oiled paper, cloth or tape. Manufacturers, as a rule, list three kinds of manufactured mica plate. The first, so-called molding plate softens and becomes flexible when heated, and is easily molded or rolled into tubes, being especially suitable for conical and band rings, slots, troughs for armatures and magnet spools as well as for low-voltage transformer insulation. The second kind is segment plate for insulating commutator copper

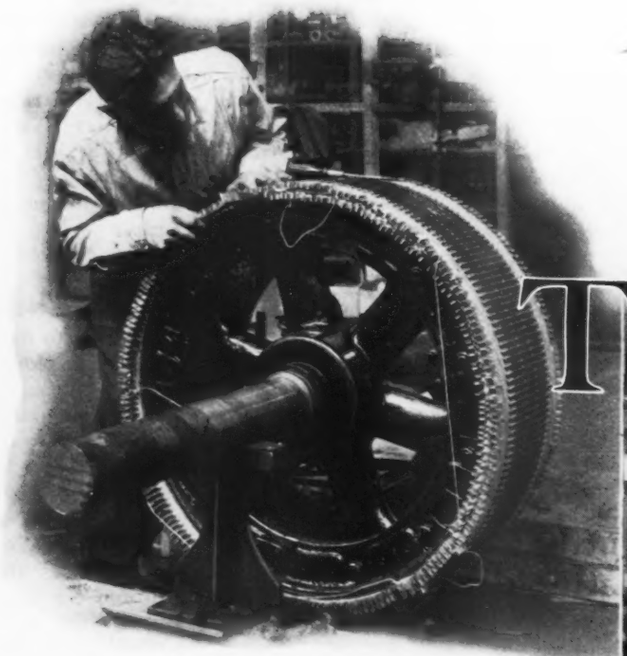
(Continued on page 70)

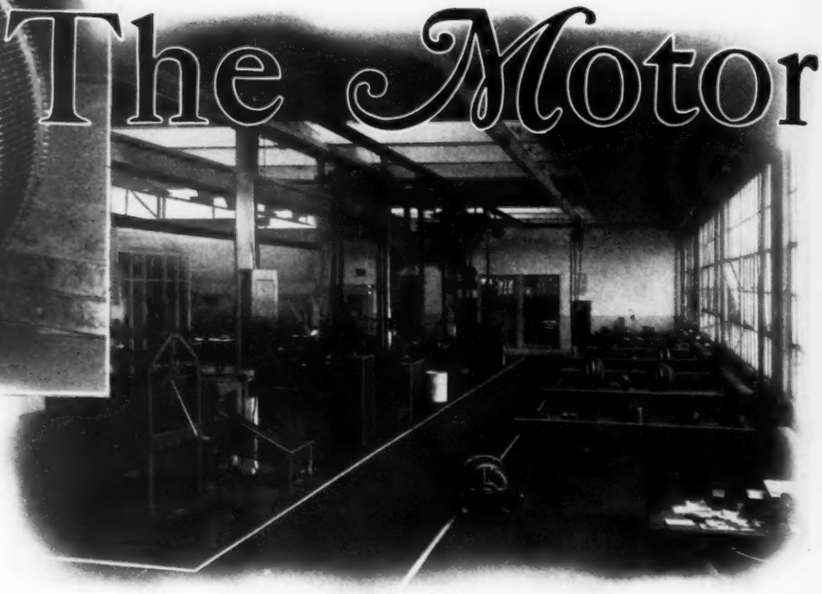
Courtesy of Western Electric Co.

Just as primitive as the mining methods are those employed for trimming and splitting mica after it has been mined. Notice the crude tools in use by the natives for performing these operations

Adequate Facilities for Efficient Operation

The Motor





A TYPICAL example of some of the work done in the motor repair shop of Berger Brothers Electric Motors, Inc., is shown above, while the view at the right shows the machine department and benches in the repair section

The motor repair shop of Berger Brothers Electric Motors, Inc., Rochester, N. Y., is fully equipped for making repairs on any kind of electrical apparatus

By WILLIAM W. BAXTER
Associate Editor, ELECTRICAL MANUFACTURING

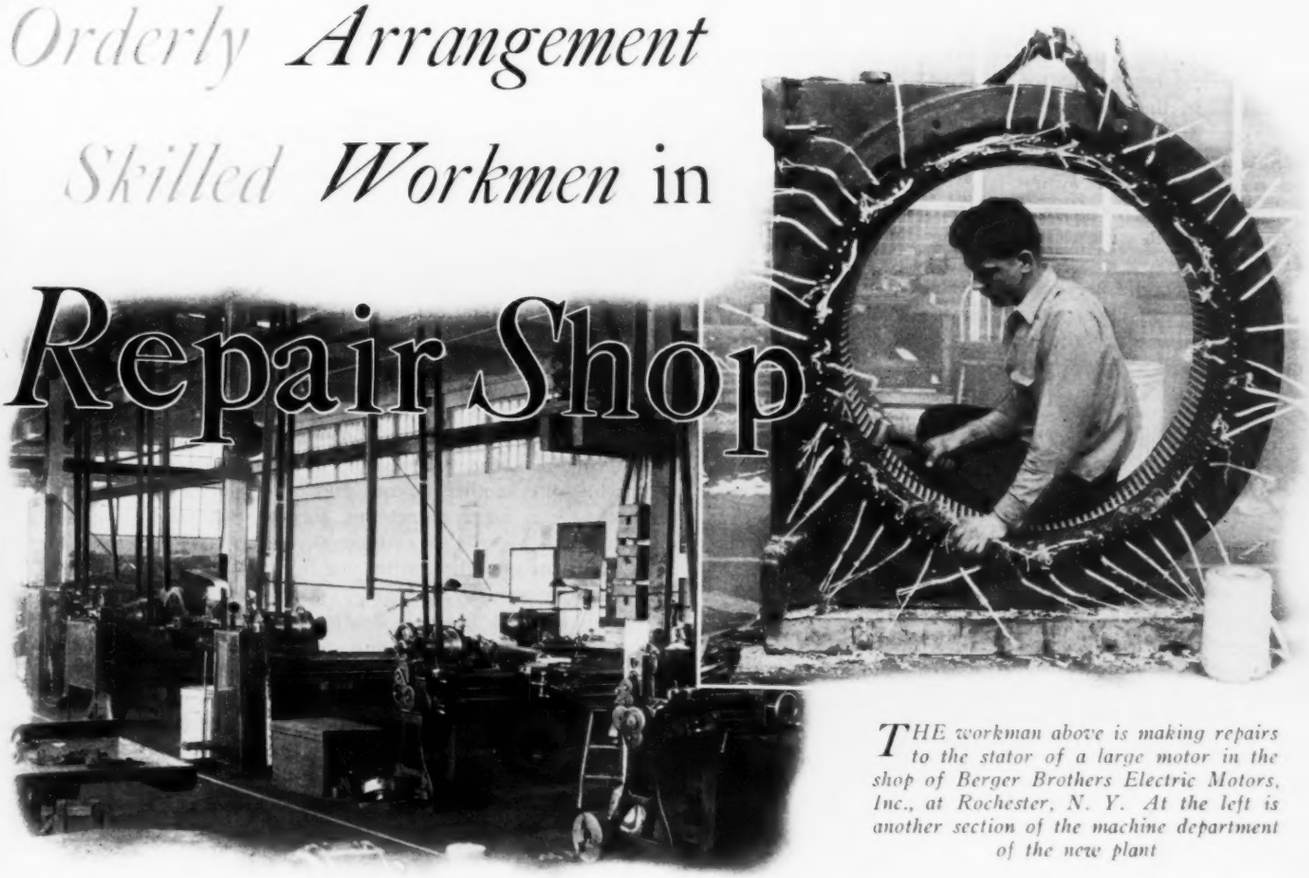
PROBABLY no other independently operated motor repair shop in the eastern section of the United States, devoted solely to the reconditioning of electrical apparatus, is as adequately fitted for making all manner of repairs to electrical equipment as is that of Berger Brothers Electric Motors, Inc., at 1346 University Avenue, in Rochester, N. Y. Only the most skilled workmen are employed in the shop and they are provided with every needed facility, in the way of equipment and tools, as well as good light and clean, orderly suroundings, to the end that they may produce the best workmanship in an efficient manner.

Berger Brothers Electric Motors, Inc., began in a humble way some nine years ago when the present organization set up a motor repair business with but a few workmen in a small factory having about 300 sq. ft. of floor space, at 36 North Water Street, in Rochester. So rapid was the growth of the business that in less than three years the size of the shop increased ten times, in point of floor space and number of workmen employed.

In the next three years the demands for more extensive facilities made it necessary for Berger Brothers to move their shop to 91 St. Paul Street, where they occupied an area of 15,000 sq. ft. Three years later they were again forced to acquire additional facilities, so that now they occupy upward of 35,000 sq. ft. of floor space in a modern factory building, situated on one of the principal streets in Rochester and in addition there is the advantage of a railroad siding with connections to the principal railroads in the Lake region.

Here is shown the office of Berger Brothers Electric Motors, Inc., located at 1346 University Avenue, Rochester, N. Y. The shop is directly behind the office and occupies two floors of this large industrial building with additional storage space adjoining

Orderly Arrangement Skilled Workmen in Repair Shop



THE workman above is making repairs to the stator of a large motor in the shop of Berger Brothers Electric Motors, Inc., at Rochester, N. Y. At the left is another section of the machine department of the new plant

Naturally, as larger quarters were obtained more workmen have been added until today Berger Brothers employ some forty skilled mechanics regularly. These, because of the character of the work in the shop, are essentially specialists in their respective classes of work. Inasmuch as the shop is divided into departments each of these men is assigned to some specific duty. There are some who do little but testing, others are machinists, some wind coils, while others handle the general repairs, such as dismantling and assembling the apparatus undergoing repairs. Then, too, in a shop of this kind there must be a corps of mechanics fully capable of making any kind of electrical installations or repairs.

The new shop of Berger Brothers, occupied in October of last year, takes up two floors of a modern industrial building, with additional space on the ground floor for the storage of heavy apparatus. All work entering the plant is received either by motor truck or railroad and from the time it is placed on the receiving platform until the job is finished, it is handled throughout the shop by means of cranes or hoists. In the storage bay, to facilitate the handling of heavy motors, generators, control apparatus and the like, there is an overhead traveling crane, while every bench, machine or department in the shop is served by an overhead monorail system equipped with electric and chain hoists.

Too much emphasis cannot be placed upon the fact that Berger Brothers appreciate the advantages to be had from the mechanical handling of work and materials. Engineers have established that as an average fifty per cent of the cost of production is in the handling. Then, aside from the elimination of much manual labor, there is the advantage to be had from increased speed in production operations.

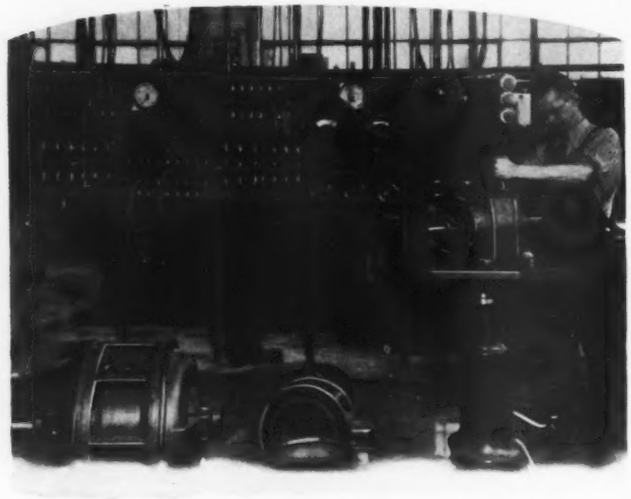
The coil department is adequately equipped for the manufacture of any type of coil or winding now in general use. Notice the modern facilities and their convenient location near the source of supply. Overhead is a monorail system for handling materials

In this shop every movement in the repair of the usual types of electrical apparatus has been anticipated so that the shop has been arranged in such a manner that all work moves from department to department in regular scheduled sequence. Thus it is that confusion is prevented, permitting of the neat, orderly arrangement of the plant. Only such work or materials are allowed on the floor of this shop as are actually being used or being repaired at the time. Such an arrangement as this makes for cleanliness and creates not only a pleasant en-

vironment for the workman but a desire on their part to do work in keeping with their surroundings.

No work is too large nor is there any job having to do with electrical equipment too difficult for Berger Brothers to tackle. In the machine shop section of the plant there are lathes, drill presses, milling machines and many other machine tools, both large and small, so that parts of any type of apparatus of either large or small capacity can either be manufactured or repaired. This, of course, includes shafts, bearings, spiders and many other similar pieces of motors.

The same conditions exist in that section of the shop known as the coil department. Here is to be found all the equipment needed for the production of practically every type of coil or winding in common use. In this department are winding and taping machines of different types



Adequate testing equipment is one of the essentials of any modern motor repair shop, and Berger Brothers have their full complement, including apparatus for making any kind of test to any kind or type of electrical equipment

and coilspreading and forming equipment. To facilitate the work in this department tables or stands have been provided for the workmen and these have revolving tops adjustable to convenient working heights. These are used primarily for making repairs to stators; frames and the like and their use greatly expedites the assembling or removing of coils and windings. In this same section of the shops, for work on armatures or rotors of the smaller types benches are provided. All of this equipment is conveniently near the material supply room so that little time is lost by the workmen in withdrawing wire insulation and other materials from stock.

Directly opposite one division of the machine department of the shop is another section used for other types of bench work. In this department such repairs are made do not relate to the coils or windings. These include the fitting and assembling of bearings, all work on brushes, shunts, commutators and frames. Then too, control apparatus for electrical installations is reconditioned here.

Practically all repairs to devices of large capacity are made in one section of the shop and on the ground floor, where there is ample equipment available for handling the heavy parts. In following this practice only such of the heavy pieces to be reconditioned require any handling to the various sections of the shop, thereby eliminating much unnecessary labor as is the case in many plants where heavy work is performed remotely from the ground floor.

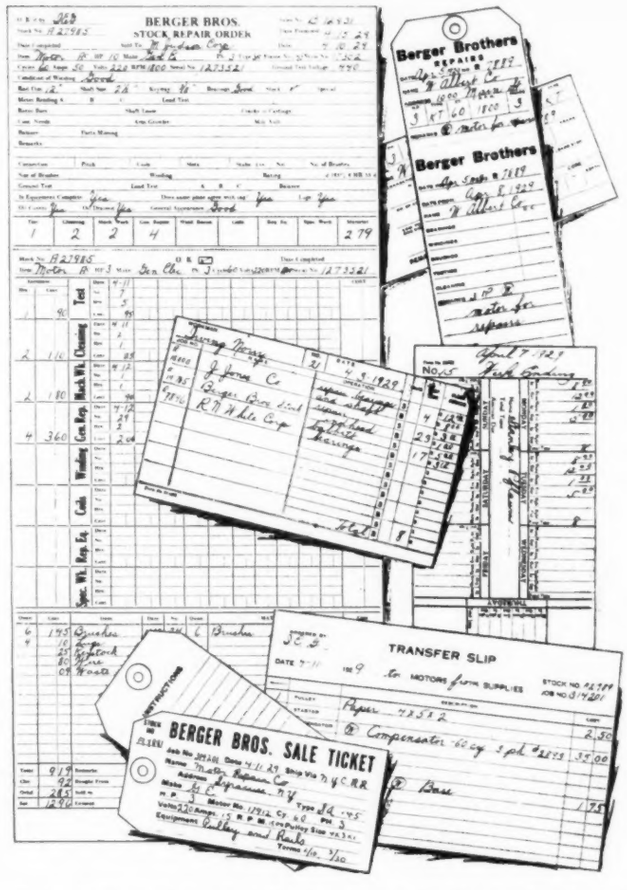
Other equipment in the shop is that for impregnating coils and windings with the necessary insulating materials. This includes dipping vats, with, of course, the usual dripping racks and the baking oven, the latter being heated with electricity and thermostatically controlled.

Equally essential in a motor repair shop is adequate testing equipment. In the Berger Brothers shop this is located on the ground floor, near both the shipping department and the storage bay. With this arrangement all work can be tested both as it enters and leaves the shop or is stored for future sale. In the test department there is every type of device or equipment needed to apply a thorough test to every piece of electrical apparatus received. Current of any voltage, phase or amperage is available for these tests. After repairs have been made to any job the apparatus is thoroughly cleaned and once it has been tested and found correct it is painted.

In mentioning apparatus stored for resale it should be understood that Berger Brothers not only repair electrical equipment but a large part of their business is that of buying and selling electrical apparatus. Much of this equipment, of the larger capacities, is placed in the storage bay, while the smaller motors and other devices are stored on racks in a large storeroom, located near the shipping department. All of this equipment, either large or small is first placed in good operating condition before it is offered for resale.

Associated with Berger Brothers Electric Motors, Inc., is the F. W. Kiemle Company, of Toledo, Ohio, formerly the motor division of The Lake States General Electric Company. The F. W. Kiemle Company is essentially engaged in the motor repair business and at the same time, like Berger Brothers, buys and sells all kinds of electrical apparatus.

It too, occupies a modern, efficiently equipped factory having about 20,000 sq. ft. of floor space, in which some



Reproductions of some of the forms used by Berger Brothers in the keeping of accurate cost accounting records of all work performed in their shop. These with others on the next page serve to give accurate costs of every operation and all materials used

twenty workmen are employed, so that between the two organizations they are able to serve well all of the industrial territory in western New York, northern Pennsylvania and the lake regions of Ohio. At present both of these organizations confine their operations largely to industrial equipment, although the Rochester shop handles a number of railway motors and is now engaged in changing over many motors in the vicinity of Rochester to conform with requirements in recent changes in the source of power supply.

In addition to appreciating the advantages to be had from well arranged shops, material handling equipment and modern shop methods, both Berger Brothers and the F. W. Kiemle Company realize the importance of knowing, accurately, values, costs of labor and materials as well as fixed operating charges. In order that they may have this information so that it may be carefully analyzed in all of its phases both of these organizations use a carefully devised and most thorough system of cost accounting and record forms. Many of the more important of these forms are reproduced in the accompanying illustrations, and their various uses will be explained as the methods of shop operation are described.

As soon as a repair job is received at the shop a repair card is attached. This card, on its face, bears complete information setting out the job number, the customer's name and address with space for recording the defects or condition of the apparatus after it has been tested. On the back of the card provisions are made to record its mechanical characteristics, such as type of apparatus, number, current, phases and the like. This applies to all repair work as well as that purchased for resale.

The repair work passes directly from the receiving and test departments of the plant into the regular production lines, its place in line and the department being dependent upon the nature of the work. All equipment purchased for resale, unless it is wanted immediately, goes to storage,

The four forms numbered from 1 to 4 are used for customers' repair work, while the fifth is employed for stock repair jobs intended for resale. The small form at the bottom of the illustration is a sample of the material withdrawal requisition

The storage bay adjacent to the motor repair shop is usually stocked with all kinds of electrical equipment of practically all capacities, and these are handled by means of the overhead traveling crane to and from the shipping platform

thereby creating a reserve of repair work for the shop that serves to keep the entire shop busy at all times.

As soon as the customer's work reaches the shop proper the foreman has four forms he employs to keep records of the work and its progress. These are essentially duplicates of each other in so far as the information at the top of each is concerned. This is copied directly from information previously entered on the repair card accompanying the work. The first of these four forms is in reality the complete cost record of the job, together with a list of such attachments as were received with the apparatus or supplied for shipment. The second form is the invoice sheet containing such cost data as was entered on the first record. Form number 3 is a complete record of workmen's time and all operations performed by them, while the fourth form describes and lists the quantities and prices of all materials chargeable to the job. Once these four sheets are completely filled in Berger Brothers have a very complete record of the one particular job for which they were used. To the charges computed from these forms others such as cartage, overhead and so forth, can be added to give the total amount of billing against the customer.

For repairs to stock apparatus, or that purchased for resale, two forms are used. One of these is similar to the first two forms used for repair work and containing invoice records, while the other two contain similar informa-

(*Continued on page* 70)

Editorials

An Approach to Our Problems

DESPITE the almost bewildering variety of goods produced by electrical manufacturers, there seems to be a surprising similarity in the problems which they are encountering today in the conduct of their business. Elsewhere in this issue of ELECTRICAL MANUFACTURING is published a summary of these problems as they have been discussed in letters from manufacturing executives to the editor. In this summary, as in the letters also, the questions of marketing easily take the lead over those of production or of administration. And almost regardless of the kinds of goods made the marketing questions are similar. Whether the manufacturer makes toasters or panelboards, he is eager to know, among other things, how the market can be expanded, how he can find and keep the best channels of distribution, what to do about substandard materials and appliances, and what is the answer to ruinous prices.

What is the significance of this common interest in markets? Simply this, that whereas there was a day when the factory ruled the market, today the market rules the factory. Today the manufacturer who would forge ahead, indeed the manufacturer who would even hold his own, must plan his production from market back to plant rather from plant out to market. This is a condition which has become more and more firmly fixed for six years and which the most thoughtful economists expect will continue for many years to come. And woe betide the manufacturer who cannot adjust his business to the changed order of things.

Without question there are serious problems relating to both production and distribution. The question is not one of obtaining sufficient production. It is a question of the intelligent control of production, control that is determined very largely by marketing factors. It becomes an exceedingly important question, therefore, as to what can be done to bring about more intelligent control of production in a greater number of electrical manufacturing concerns.

A manufacturing executive, in discussing this subject with the editor, stressed an approach to our problems which, if pursued, should certainly bring about more of the kind of executive control that is needed today in the electrical manufacturing business. He said, in part:

"To accomplish this, we must achieve a general state of mind which is favorable to the collection and use of facts. This implies a willingness to supply facts for the use of others, always supposing that proper safeguards and accepted methods and procedure are followed. We must obtain a steady flow of facts. These must be studied and analyzed. Following this, there must be a willingness to do those things which the facts indicate as necessary or desirable. And if we could have wholehearted and intelligent cooperation in the collection of actual facts relating to problems of either production or distribution, you could be certain indeed that these facts would tell us just what to do."

The editor is inclined to agree rather wholeheartedly with this point of view. Out of a long experience he knows what happens when anyone attempts to collect facts from a number of business men, even from a limited membership in an association. Despite all the enthusiasm which may attend an effort to launch any kind of a business survey there can always be found individuals or concerns within the membership who refuse to play the game, who refuse to provide the needed facts or figures. And yet almost invariably these concerns are willing to profit later by whatever results are obtained by the survey. This sort of thing has happened time and time again in almost all of the existing electrical associations. Take the matter of industry statistics. As good as some of our statistics may be today, all of them could and would be far better for purposes of control than they are, if facts and figures had been obtainable from a greater number of concerns. And when it comes to incomplete statistics, the old saying that a little knowledge is a dangerous thing certainly applies with tremendous force.

Is it not true that one of the outstanding needs of the electrical manufacturing field today is for greater confidence and faith between concerns in the industry? Certainly one of the big problems of the industry, as ELECTRICAL MANUFACTURING sees it, is how to eliminate guesswork from executive offices and to establish better control based on accurate facts and figures.

You May Need These Figures

APPLIANCE manufacturers who want more accurate information about markets will find it worthwhile to look into the facts and figures compiled by the Electrical League of Cleveland following its recent marketing survey of that city. The report shows how far from saturation is the local market on each of the various electrical appliances for the home. It provides a means of arriving at a sales quota and should be of definite value to any appliance manufacturer selling his goods in the Cleveland territory. Such a survey is only one of the many valuable services which a live electrical league can render to the industry.

Good Housekeeping

NO sane man would tolerate unsanitary or untidy conditions in his home, yet some of them appear to overlook such matters in the conduct of their business. It is not an uncommon thing for one to walk into a shop or factory and find the most disorderly conditions imaginable. Windows are often so dirty as to exclude natural light and many of them are at times broken. Artificial light in many instances is entirely inadequate. Tools and materials are strewn all over the floors, benches and machines, without thought of order, showing in general the utter disregard for good housekeeping.

One need not be an efficiency expert to know that the best in workmanship and product cannot be had among such surroundings. Experience teaches that workmen produce in accordance with their surroundings. Give them a dirty, disorderly, poorly lighted shop to work in and they will deliver in kind. Change their environment into clean, orderly, well-lighted shops and they will give the best that is in them. Natural light is the best, but

when this is not available then adequate artificial illumination should be provided. Likewise, there is no excuse for dirty floors, nor is there anything to be gained by scattering tools and materials over the floors, benches and machines, without any thought to order.

"A place for everything and everything in its place," is an axiom that needs no explanation. In the same manner it was once said that "cleanliness is next to godliness," and if there is any one thing many shops and factories need it is a little more godliness—to get them started in the direction of cleanliness.

Standards for Appliance Performance

PERFORMANCE is just as important a factor in the design of household appliances as are the factors of appearance, production and marketing. So far as the housewife is concerned, and aside from appearance, she is only interested in what the device will do at a minimum cost to her. A percolator, for illustration, may be made beautiful and yet be "absolutely impossible" when it comes to making good coffee most economically. Toasters are on the market that scorch the center of a slice of bread and do not toast it elsewhere. Electric refrigerators may be had that are far from efficient and the worst part of it is that many manufacturers of these and similar products apparently do not know just what makes for efficiency in their respective devices.

There have been standards of good performance fixed for practically every type of household appliance and for his own good every manufacturer should avail himself of these standards. They have been established by concerns like the *Good Housekeeping Institute,* where for a long period of time, every device submitted for examination and test has been compared with those of like kind. From the performance data obtained in this way comparative tables and information have been arrived at and the averages of these constitute the standards.

Not only is the performance of every device submitted to the *Good Housekeeping Institute,* and other institutes like it, tested thoroughly, but in addition the device or appliance is completely torn down so that its details of construction and the quality of materials used can be examined and compared. Thus, there is established the double standard of performance and construction. Any appliance submitted to the *Good Housekeeping Institute* receives the same tests as others in its class and the results of these tests are reported only to the maker of the device.

Watch the Little Things in Designing Metal Stampings

A LETTER recently received by the editor from a manufacturer of metal stampings brings up again the fact that many electrical manufacturers fail to consider small, but important, points in the design of electrical products using stampings that will make for ease in assembly, lower cost of dies and consequently lower cost of the finished product. Three paragraphs of this letter set forth the usual demands made on the stampings specialist very clearly:

"We specialize in the manufacture of stampings to be made from electrical sheets and to be used in the building of transformers for various radio purposes. A great many of these laminations have two or more holes in them for the purpose of assembly. Usually a machine screw is used in these holes. The general tendency in the original design prepared by the electrical manufacturer is to allow very little clearance in these holes over the body diameter of the screw being used. This tends to cause increased assembly time and in many cases we have recommended that these holes always be at least 1/32 in. larger than the diameter of the screw being used.

"Again, these holes, as originally designed, may be so small that a very small punch is required to make them. The life of a punch, smaller than 5/32 in. in diameter, where silicon sheet is being punched, is relatively short. We recommend, therefore, that if possible a hole 3/16 in. in diameter or larger be used which will add materially to the life of the punch.

"It is also good general practice in the manufacture of such laminations to avoid sharp corners. A radius of at least 1/64 in. and preferably 1/32 in. or larger is recommended. Where it is necessary to make a punch with sharp corners, these corners tend to wear faster than the rest of the die, thereby reducing the ultimate life of the tool."

Here are some points that all manufacturers of products using stampings should consider. When we stop to think about these problems, it seems that no one would forget to allow clearance for the screw holes and any manufacturer ought to realize that it is more costly to build a die having a square corner, in addition to the fact that this corner will wear faster during punching. Yet ignorance of this kind is displayed repeatedly. Remembering these points when the original design is made up will decrease manufacturing time, the cost of the dies, the cost of the stampings themselves and, therefore, will result in a lower cost of the finished product.

Labor Turnover

STABILITY of employment is as important to the employer today as it is to the employee, because of the tremendous annual cost involved. It has been estimated from available statistics on the subject that labor turnover averages from 30 to 50 per cent in many industries and that the cost of training each new employee ranges from $50 to $200.

Therefore, and using these averages as a basis, in a plant having 1000 workmen, and allowing a minimum separation rate of 30 per cent, with the cost of training new employees placed at $50, an employer would expend approximately $15,000 annually for labor turnover alone. On the other hand, with the same number of workmen, a 50 per cent separation rate, and allowing $200 for the training of each new employee, the employer would have an annual separation cost amounting to $100,000.

Separation rates are largely divided into six general classes: voluntary resignations, retirements, involuntary discharges, lay-offs, transfers and unavoidable separations, such as those caused by death. Retirements, because of old age or other infirmities, and those separations caused by death are beyond the control of the employer. He can though, in large measure, exercise some control over the other four classes. It is he who has full power over discharges, lay-offs and transfers, and by careful consideration of his labor problems it is possible for him materially to reduce the number of voluntary resignations.

Since the average minimum and maximum separation rates and their possible costs to the employer are so large it would appear that their study is just as important as a management problem as are those questions of production, and marketing. Most executives could well afford to learn what their labor separation rates are, what they cost annually, and why they are so high, with a view to eliminating a large part of this seemingly unnecessary expense.

Scrap Allowances in Metal Stampings

No. 5 of a Series on the Design and Manufacture of Stampings

In designing metal stampings certain allowances must be made for scrap, and these allowances vary considerably for different types of products

By J. K. Olsen

Chief Draftsman, Stewart-Warner Speedometer Corp.

IN the manufacture of stamped or punch press parts it is of course necessary to use raw material of strip or sheet form. The size of the sheet or strip is of course determined by the dimensions of the parts to be stamped and in practically all cases it must be sufficiently large to provide a margin of material all around the piece to be made.

This margin is called the scrap allowance and will vary slightly in width due to the design and size of the part, the construction of the die, the speed of production and the thickness of material.

There are some few parts which are stamped out with no scrap allowance between the part and the edge of the raw material, however, the general run of parts which must be flat or uniform are necessarily made from strips of sufficient width to provide a scrap edge. This applies especially to blanked out parts which must be held to close limits.

It should be noted at this time that the scrap portion of the raw material is in no manner connected with the figure for waste, the scrap is in addition to the regular percentage allowed for waste in all cases.

A good general rule for average production of stamped parts is to allow one thickness of stock between the part and the edge and one thickness of stock between parts.

The following table is given in conjunction with this general rule and is taken from actual practice in a manufacturing method where the allowance is made sufficiently wide to take care of a rather high speed production rate in preference to extremely close raw material estimates.

Scrap Allowance for One Thickness at Edge of Stock

Thickness of Stock	Diameter of Blanks in Inches							
	1	2	3	4	5	6	7	8
0.035...	0.047	0.062	0.078	0.093	0.109	0.125	0.141	0.156
0.050...	0.062	0.078	0.093	0.109	0.125	0.141	0.156	0.172
0.065...	0.078	0.093	0.109	0.125	0.141	0.156	0.172	0.187
0.080...	0.093	0.109	0.125	0.141	0.156	0.172	0.187	0.187
0.100...	0.109	0.125	0.141	0.156	0.172	0.187	0.187	0.187
0.130...	0.141	0.156	0.172	0.187	0.187	0.187	0.187	0.187
0.160...	0.172	0.187	0.187	0.187	0.187	0.187	0.187	0.187

When the thickness of stock on the diameter of blank is of a dimension lying between the figures given in the table, the next largest figure should be used. For stock 3/16-in. or over in thickness, the scrap allowance between parts and between parts and edges should be made equal to the stock thickness.

It should be noted from the table that the ratio of scrap allowance size increases in proportion to the increased diameter of the blank.

In some few cases the scrap allowance for stock between parts and between parts and edge may be reduced to 70 per cent of stock thickness. This unusually low allowance is made possible only by the fact that the small width of stock can be made to come at opposite points in parts such as washers, etc., where the material would increase rapidly in width at each side of the 70 per cent of stock width.

Taking the part illustrated in Figure 1, we find the thickness of stock to be .0625 and by using the 70 per cent con-

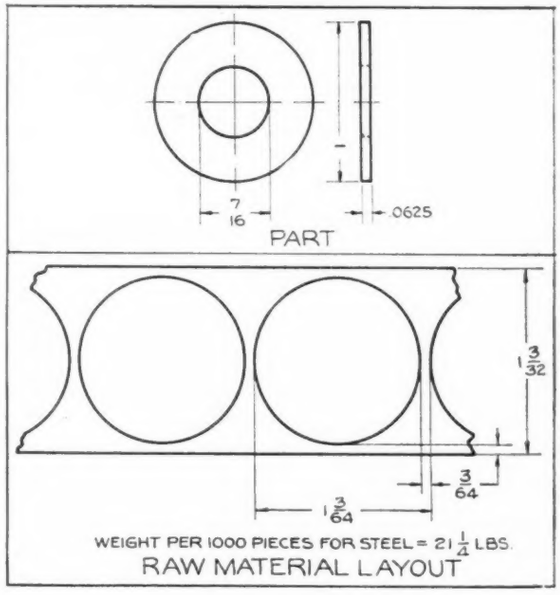


Figure 1

A typical example of a simple stamping showing the dimensions of the part and the manner in which it is made from strip materials, with the proper allowance at the sides and between the various pieces for scrap

stant we proceed to find the theoretical scrap allowance; the stock thickness, (.0625) times the constant (.7) equals .04375. For convenience in figuring large quantities of parts accurately, the theoretical result is increased to the next largest fractional figure which in this case would be 3/64.-in.

The multiple, or the amount of stock required to make one part with the scrap allowance added to it, is found by taking the diameter of one part and adding the scrap allowance to it. In this case it would be one inch plus 3/64-in. or 1 3/64-in. as shown in the illustration. The same scrap allowance would also be used in determining the width of stock by taking the diameter of the part and adding the scrap allowance to each side. In this case the result would be 1-in. plus 3/64-in. plus 3/64-in. = 1 3/32-in. which would be the width of strip required for blanking the part.

In estimating materials for punched out parts it is customary to figure the weight per thousand pieces and for this purpose a simple formula has been developed.

The method is simply to multiply the area of one piece by the weight of the raw material per square foot, then multiply this result by 7.292.

A = Area of one piece in square inches.

W = Weight per square foot of raw material.

7.292 = Constant.

Formula for weight per 1000 pieces = A x W x 7.292. This formula includes 5 per cent for waste.

Note that the area of one piece must include the scrap allowance for the part, that is, if the part is a punch press or stamped out part, the area for one piece is the width of strip times the multiple.

The weight per thousand pieces of the disc shown in Figure 1, as determined by the formula which includes the 5 per cent allowance for waste would be 21 1/4 pounds, providing the part was made from steel stock.

While discussing weights, it might be a good idea to suggest that all weights should be given in even figures or main fractions with the exception, of course, of special, high cost material or very small weights. Since a percentage allowance is given for waste and the scrap is figured in the total, it should not be necessary to specify a fancy fractional or decimal figure for the weights as in ordering material for production runs. The weight per 1000 pieces is multiplied by the number of parts required and any chance of making errors in this calculation should be eliminated, thus a plain or even figure will assist materially in reducing the possibilities of mistakes in addition to being much easier and faster to use.

In order to use an even weight figure the waste percentage must in some cases be increased to 6 per cent or reduced as low as 4 3/4 per cent and in line with this idea a table is included which will give a general idea of a practical method in determining the closest rounded-off figure.

Nearest Even Figure in Pounds

Below 5 lb. use decimals.							
From	5 lb.	to	10 lb.	specify figure in	.05	lb.	steps
From	10 lb.	to	15 lb.	specify figure in	1/8	lb.	steps
From	15 lb.	to	30 lb.	specify figure in	1/8	lb.	steps
From	30 lb.	to	60 lb.	specify figure in	1/4	lb.	steps
From	60 lb.	to	90 lb.	specify figure in	1/2	lb.	steps
From	90 lb.	to	200 lb.	specify figure in	1	lb.	steps
From	200 lb.	to	500 lb.	specify figure in	2	lb.	steps
From	500 lb.	to	1,000 lb.	specify figure in	5	lb.	steps
From	1,000 lb.	to	2,000 lb.	specify figure in	10	lb.	steps
From	2,000 lb.	to	5,000 lb.	specify figure in	25	lb.	steps
From	5,000 lb.	to	10,000 lb.	specify figure in	50	lb.	steps
From	10,000 up.						

In this table it should be noted that, with the exception of weights below ten pounds, all fractions used are multiples of ounces and whole figures.

This table should be used in specifying weights for all raw materials, such as rod stock, sheet and strip stock, etc. The weight is figured in the usual way in order to specify an even weight figure on the part drawing.

Determining Material Needs

SUPPOSING a part weight figured 25.130 pounds; by using the table we find that weights between 15 and 30 pounds should be given in 1/8 pound steps, therefore the weight, 25.130 pounds, would be given as 25 1/8 pounds, still leaving a waste allowance of over 4 3/4 per cent. We will now assume that a weight figured 28.157 pounds. This would have to be increased to 28 1/4 pounds which would still leave a waste allowance of less than 6 per cent. This weight would not be decreased to 28 1/8 pounds since it would then leave less than 4¾ per cent for waste.

In a layout of this type in which the straight sides of the part are parallel to each other and to the edge of the strip,

The following table is given in conjunction with the it is always advisable to allow .9 of stock thickness, or as previously stated, 90 per cent for both the scrap between parts and edges and between parts. In case this theoretical figure is found to be some uneven decimal it should, of course, be increased to the next largest fractional size.

In blanks of odd and irregular shapes it is well to use caution in deciding upon the scrap allowance to use owing to the peculiarities of the action of stock in the complicated dies. A good safe rule which is in harmony with previously mentioned allowances is to use stock thickness as a constant for materials above 1/32-in. in thickness and 1/32-in. for stock less than this thickness.

The accurate estimating of scrap material is of major importance in making up requirements for raw material, for it may be readily seen that an allowance either too small or too large for scrap may mean the difference between running short of stock or having an undesirable excess.

Summing up these facts, the ideal raw material estimate is one which is so accurately balanced that it will insure a sufficient amount of stock for the required number of parts with an absolute minimum of excess material. When this ideal condition exists, the cost figures for the production of the series of parts will never be out of proportion due to poor estimating of scrap allowance.

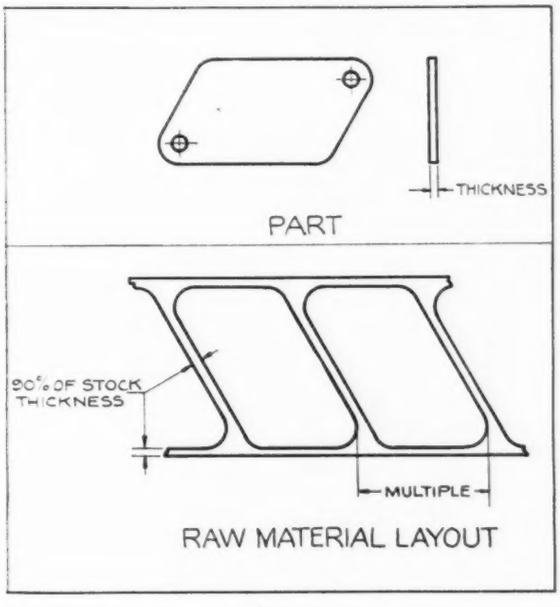


Figure 2

This stamping is considerably different in shape from that shown in Figure 1, but the same rules and formula are used for spacing the piece on the strip stock and for estimating the scrap allowance at the sides and between pieces

This concludes the series of five articles on metal stampings which started with January, 1929, issue.

Characteristics That Determine the *Selection* of MOTORS

No. 13 of a Series Discussing Motors of Different Types

While A. G. motors have replaced the D. C. type there are still many applications for which various types of the latter are admirably suited

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AND

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WHEN considering direct current motors for any application, first consideration must obviously be given the necessary direct current power supply.

The preponderance of alternating current systems naturally causes the buyer first to consider the many types of alternating current motors before deciding on a direct current motor for his application. This, of course, depends to a large extent upon his primary source of power.

While it may be said that A. C. motors have replaced D. C. motors for many purposes, still there are numerous applications for which the various types of direct current motors are eminently suited.

Many industrial plants have installed their own generating stations for generating direct current, realizing the many advantages inherent in direct current motors, particularly with respect to flexibility and efficient operation. Other plants install rotary converters or motor generator sets converting alternating current to direct current, to accomplish the same result. The cost of such installations is usually considerable, so that there must be sufficient justification through increased operating efficiency and economy of production to warrant the large initial investment.

It is perhaps not generally realized to what large extent direct current motors are still used in a number of widely diversified industries. For that reason we shall endeavor to point out the fundamental characteristics of direct current motors, followed by an analysis of the most important applications, and then a more detailed discussion of several characteristic applications, including the essential features of control in each case.

Characteristics—Figure 1 shows a typical D. C. motor without base or pulley. From the standpoint of mechanical features, this motor, as shown, is adaptable for mounting upon a machine base, with a shaft extension arranged for direct coupling to the machine. The motor frame and construction are typical of the open type, sleeve bearing motor. It is also becoming quite common practice to use ball or roller bearings on direct current motors which is quite in line with the same features of the alternating current motors that were discussed in previous articles of this series.

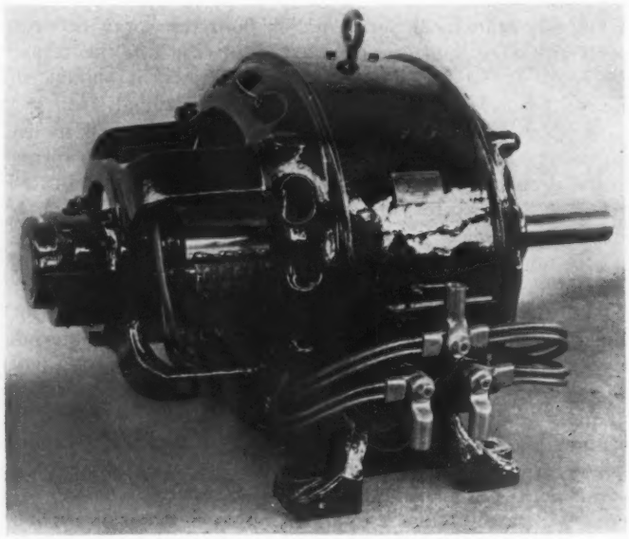


Figure 1

A typical D. C. motor without base or pulley. It is adaptable for mounting on a machine and has a shaft extension for direct coupling to the machine. The frame and construction are typical of the open type sleeve bearing motor now being commonly used

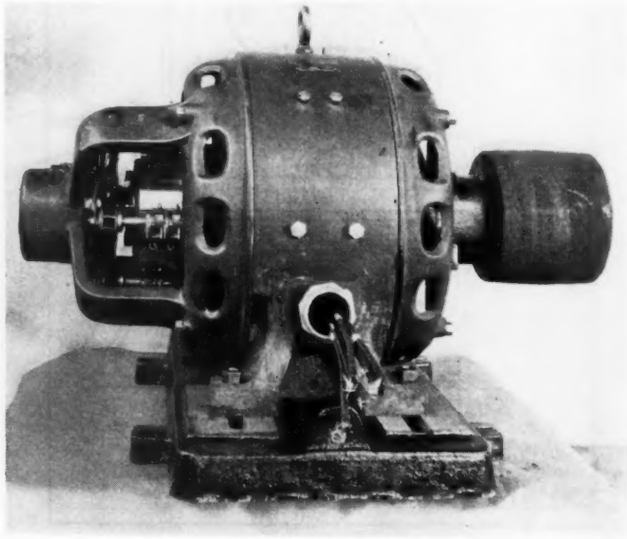


Figure 2

A typical D. C. motor arranged for belt drive, with pulley and slide rails. In this case the leads are brought out through the center of the frame and are arranged for conduit connections, such as would be required in the case of permanent mounting

Figure 2 shows a typical D. C. motor arranged for belt drive, with pulley and slide rails. In this case the leads are brought out through the center of the frame and are arranged for conduit connections.

Figure 3 shows an enclosed type D. C. motor such as would be used where dust and dirt are excessive, so that it becomes necessary to protect the windings and commutator, in order to keep maintenance costs at a minimum.

Figure 4 shows a direct current motor of the armature shifting type. In this case the shifting of the armature is accomplished manually, using the handwheel as shown. Sometimes automatic operation is secured by using a cam drive from the machine the motor is driving.

Figure 5 shows a back geared arrangement where the motor and reduction gear features are combined in one unit. This arrangement is suitable for slow speed drives.

Figure 6 shows an open type and Figure 7 an enclosed

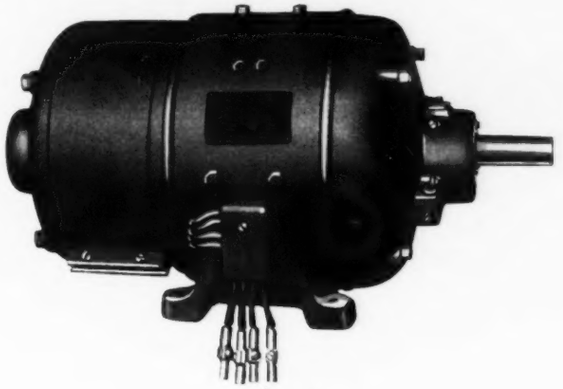


Figure 3

An enclosed type D. C. motor such as would be used where dust and dirt are excessive, in which case it becomes necessary to protect the windings and commutator in order that maintenance costs may be kept at a minimum

mill type D. C. motor, typical of the construction motor manufacturers have developed in a successful effort to build a motor suitable for steel mill drives and other applications where the motor is subjected to severe peak loads. Both of these motors as shown are suitable for mounting on a machine base, for direct or geared drive; or the motors may be equipped with pulley and slide base for belted service. Note particularly, the sturdy compact frame construction.

In general the electrical characteristics of direct current motors are relatively simple and have been long understood and accepted by both designing and operating engineers. However, a discussion of these characteristics will be essential in order to properly analyze the different types of applications.

In the October, 1928, issue of ELECTRICAL MANUFACTURING, brief mention was made of direct current motors, particularly, with reference to constant speed drives. That information will be further amplified and discussed from the standpoint of varying speed and adjustable speed drives. This field of application for direct current motors has more

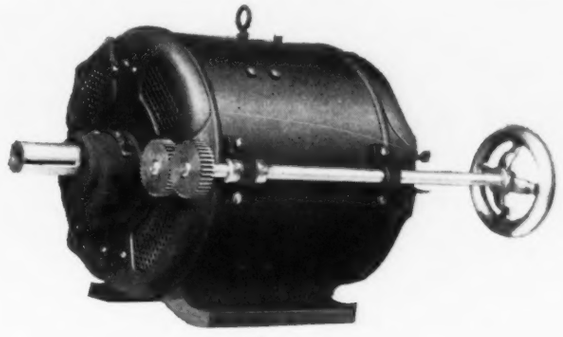


Figure 4

A D. C. motor of the armature shifting type, in which the shifting of the armature is accomplished by means of the handwheel at the right. Automatic shifting is used at times by means of a cam driven by the machine to which the motor is attached

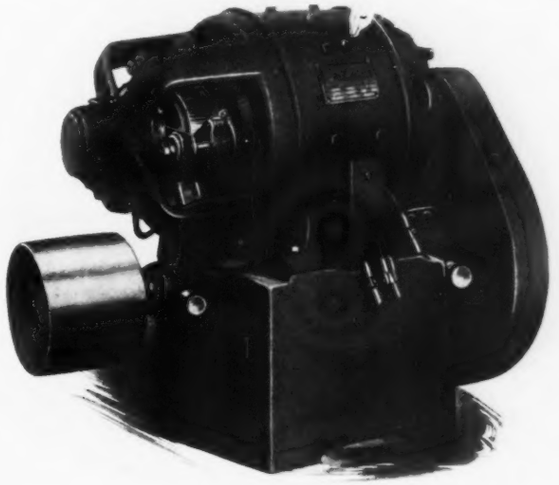


Figure 5

A back-geared motor so arranged that the motor and reduction gear are combined as one unit. Such an arrangement as this is suitable for use where slow speeds are required, and in mounting both as a unit considerable expense is saved

importance and requires a more complete analysis of the motor characteristics together with the accompanying control apparatus.

Figure 8 shows typical speed torque curves for the three types of direct current motors; namely, shunt wound, compound wound, and series wound motors.

It can readily be seen that the speed characteristic of the

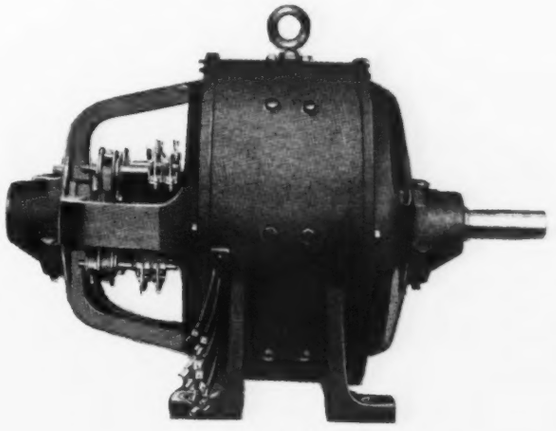


Figure 6

An open type D. C. mill motor typical of the construction motor manufacturers have developed in an effort to build a motor suitable for steel mill drives and other applications where the motor is subject to severe peak loads

shunt wound motor is practically independent of load, and that the speed characteristic of the series motor depends entirely upon load, while that of the compound wound motor which combines the characteristics of both the shunt and series motors, lies between these two.

The shunt wound characteristics are fairly constant for all loads. In this connection, of course, the shunt motor comes under the heading of constant speed motors as discussed in the October, 1928, issue of ELECTRICAL MANUFACTURING. However, as an adjustable speed motor, a different speed will be developed on each step of the field rheo-

stat. When used in this way, the motor can be adjusted within a minimum and maximum range; and when once adjusted, it retains its fundamental characteristics; namely, practically constant speed for all loads at the adjusted speed.

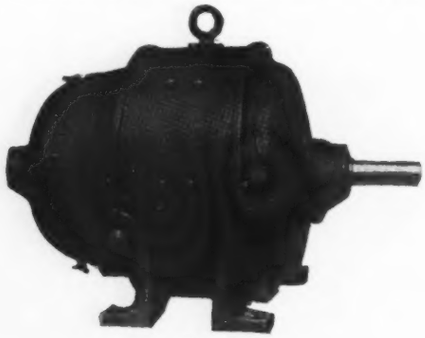


Figure 7

An enclosed type D. C. mill motor similar to that shown in Figure 6. Both of these motors are suitable for mounting on a machine base, for either direct or geared drive, or the motor may be equipped with a pulley and slide base for belt drive

It is well to remember in this connection that commercial shunt wound motors are available with as wide a speed range as 4 to 1. Practically any standard motor of this type can be operated within a speed range of 2 to 1. Outside of these speed ranges, obtained by field control, the motor usually becomes unstable in operation.

The series wound motor increases rapidly in speed at light loads and soon approaches a dangerous speed far above its normal speed, if the load is reduced too much. This feature of the series motor limits its use to classes of service where it is either direct connected or geared to the load; so that under no conditions can it be running with less than enough load to hold its speed to a safe value. This type of motor

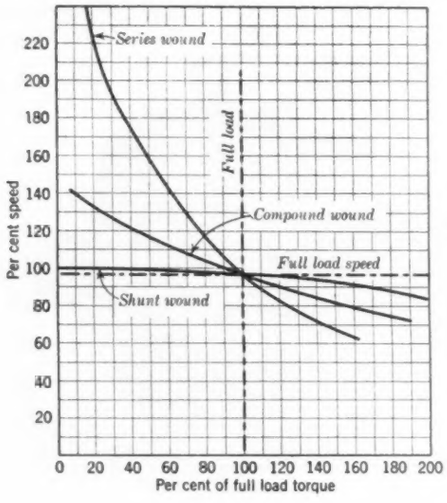


Figure 8

The speed torque curves for the three types of direct current motors; namely, shunt wound, compound wound and series wound. It will be noticed that the speed characteristic of the shunt wound motor is practically independent of load

should never be belted to its load, for, if the belt should slip off the pulley, the motor would immediately start to race and would soon reach such a high rate of speed, that it would fly to pieces, with probable injury to life and property. In electric railway service, for example, the motor is always either geared to the axle, or direct mounted on the axle, so that there is never a possibility that it would develop a runaway speed.

The characteristic of the compound wound motor approaches that of the shunt wound motor and is far more stable than the series motor. It still retains, however, a portion of the series characteristic, depending upon the proportion of series field to shunt field used. Some motors, such as for rolling mill duty where heavy torques are required, are sometimes built with a large percentage of series field. Such motors would have practically the same speed characteristic as the series motor, with the addition of the light shunt field winding to prevent the motor from running away in case the motor is accidentally disconnected from its load.

Figure 9 shows the characteristic current torque curves for the three general types of direct current motors. These curves are based on motors having the same torque available

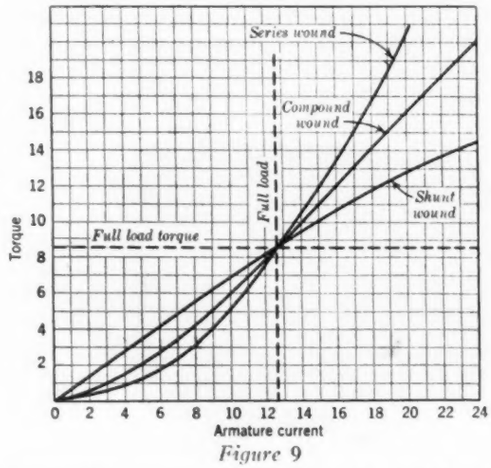


Figure 9

The characteristic current torque curves for the three principal types of direct current motors. These curves are based on motors having the same torque available and the same current drawn from the line at full load

and the same current drawn from the line at full load, which provides a good basis for a comparison of the three types.

It will be noticed that for a given value of armature current above full load, that the series motor will deliver a torque value in excess of either of the other types. In this same region the compound wound motor characteristic, as would be expected, lies between the shunt and series characteristic, developing for the same value of armature current, less torque than the series motor but more than the shunt motor.

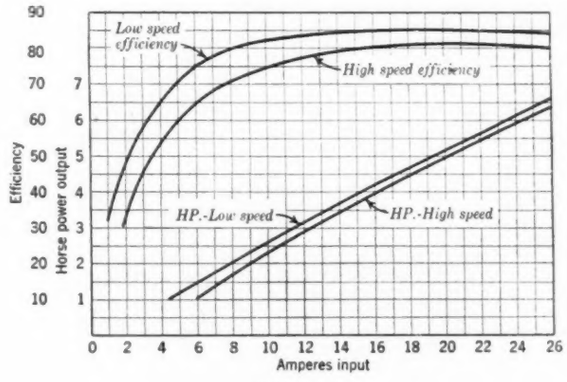


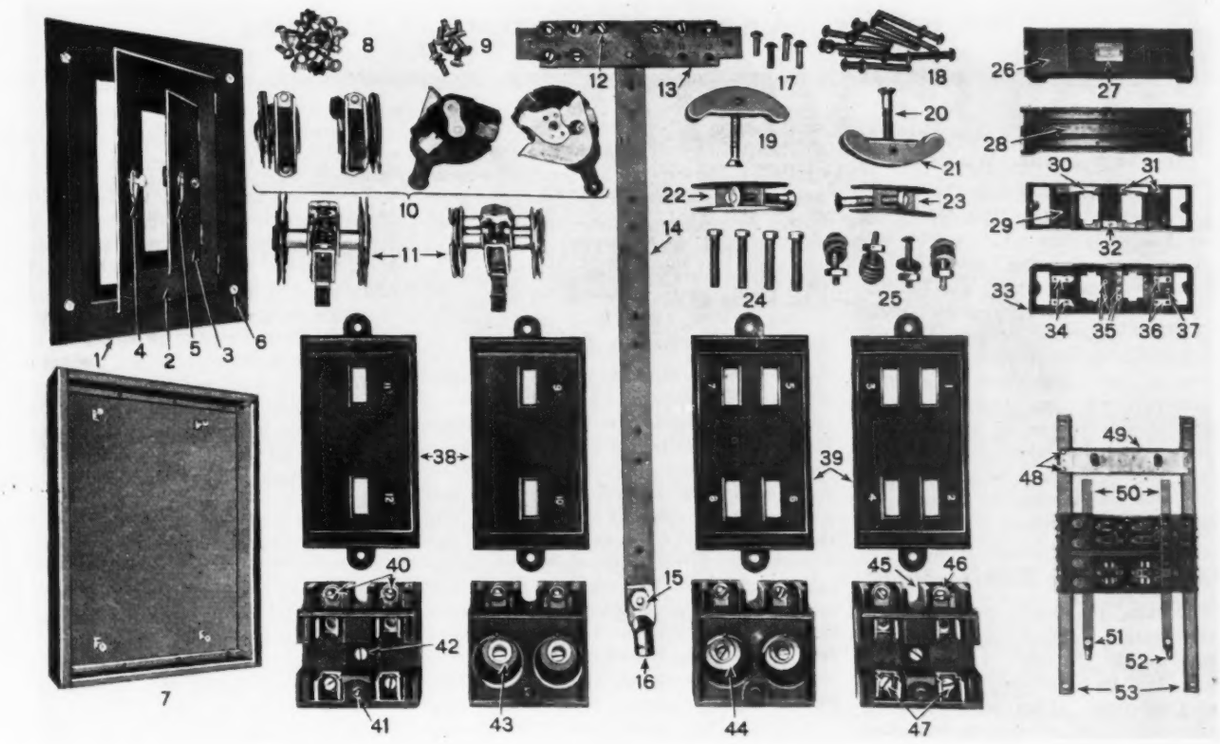
Figure 10

A comparison of the efficiencies and horsepower developed by a typical armature shifting, adjustable speed motor, for the high and low speeds in its operating range. The curves show the characteristics at both high and low speeds

Where the starting load is less than full load, it is not necessary to use the series type of motor as both the compound wound and shunt wound motors develop torque well within this range, that of the shunt type being greatest. Ordinarily, however, the selection of an adjustable speed or

(*Continued on page 72*)

Panelboard Components



Electrical Manufacturing acknowledges the assistance of the Square D Company, Detroit, Mich., in the preparation of the illustration shown above and the following table of sectional lighting panelboard parts. This is typical of many present-day panelboard installations and will serve to show the large number of parts involved in their construction, together with a list of the various kinds of materials required. From the table it may be noticed that the panelboard consists of essentially 53 different parts and in their construction some eight different kinds of metals and other materials are used

Table of Parts and Raw Materials Used in Panelboard Construction

Part No.	Description	Material
1	Trim	Steel
2	Door	Steel
3	Door	Steel
4	Lock	Steel and brass
5	Lock	Steel and brass
6	Indicating knob	Alloy
7	Box, bolt, nut and mounting piece	Steel
8	Switch hold-down screws	Steel
9	Section cover plate screws	Steel
10	Single pole switch	Steel, bronze, bakelite, formica
11	Double pole switch	Steel, bronze, bakelite, formica
12	Solid neutral binding post	Brass
13	Solid neutral bar	Copper
14	Bus bar	Copper
15	Lug screw and nut	Copper
16	Lug	Copper
17	Solid neutral binding post screws	Brass
18	Section base hold-down screws	Steel
19	Adjusting clamp	Steel
20	Adjusting clamp bolt	Steel
21	Clamp	Steel
22	Adjusting clamp bolt washer	Steel
23	Adjusting clamp	Steel
24	Panel adjusting screws	Steel
25	Shipping screws, nuts and washers	Steel
26	Blank section	Bakelite

Part No.	Description	Material
27	Name plate	Brass
28	Blank section	Bakelite
29	Section base	Bakelite
30	Contact	Copper
31	Inserts	Brass
32	Inserts	Brass
33	Section base	Bakelite
34	Contact	Copper
35	Inserts	Brass
36	Inserts	Brass
37	Inserts	Brass
38	Double pole section cover plate	Bakelite
39	Single pole section cover plate	Bakelite
40	Screws and clips	Brass
41	Insert	Brass
42	Screw	Brass
43	Plug fuse adapter	Brass
44	Plug fuse adapter	Brass
45	Fuse adapter	Bakelite
46	Clip screw	Brass
47	Fuse clips and screws	Brass
48	Screws	Steel
49	Neutral support strap	Steel
50	Bus bars	Copper
51	Lug	Copper
52	Lug	Copper
53	Channel iron	Steel

Facts, Figures and Trends

Statistical information of value to electrical manufacturers in working out policies and plans for production and marketing

Electricity Commission in New South Wales

In New South Wales the Government proposes to set up a State Electricity Commission at an early date, which will develop and coordinate existing and possible sources of electricity supply. The Government is anxious to use some of the money now available under the British Migration Agreement for the development of water conservation and hydroelectric schemes. In connection with the Wyangala Dam scheme, the Government is proposing to erect a power station where the energy of the water discharged will be used to generate current to be supplied to the surrounding towns and district.

Power Used for Refrigeration

In discussing the development of electric refrigeration, A. J. Authenreigh, vice-president of the Middle West Utilities Company, told the Midwest Power Engineering Conference at its recent meeting in Chicago that the electricity consumed for cold storage equals 310 million kw.-hours and that the small electric refrigerators that are growing in popularity for home use and moderate-sized commercial refrigerators consume 630 million and 584 million kw.-hours respectively.

Electrical Equipment Industry in Irish Free State

The approaching completion of the Shannon hydroelectric project, which will establish a uniform electricity supply for the entire Irish Free State from one power station, served as a stimulus to sales of electrical equipment and appliances during the past year. As the present per capita consumption of electricity in that country will have to be doubled in order to insure the success of the Shannon project, a vast amount of educational work has been required and the fruits of the propaganda are already apparent in the increased use of electrical equipment, especially in the field of household appliances.

Progress of British Electricity Scheme

The Central Electricity Board is actively proceeding with the reorganization of the generating and transmission of electricity throughout Great Britain. This reorganization is being conducted under five separate regional schemes and while several years will be required to complete the system of coordination, it is intended to bring parts of the scheme into operation in each area as soon as possible. Under this program it is probable that the board will be in a position to supply electricity on a small scale in both central Scotland and southeast England areas before the middle of 1929. The central Scotland area covers nearly 5000 square miles and includes practically the whole of the industrial shipbuilding and coal districts in Scotland. The southeast England scheme covers some 8800 square miles including London.

Transportation by Trailer

A present-day trend in motor truck transportation is reported to be the growing practice of attaching a string of trailers to a truck, described in *Distribution Economy* for January. One manufacturer of radio equipment is said to have shipped by trucks and trailers, in a single day shortly before the Christmas holidays, approximately $500,000 worth of his products. Interplant hauling by means of truck tractors and semi-trailers is estimated to have saved one unit alone of a large automobile concern $12,760,000 in a single year, as compared with previous hauling costs.

Public-Utility Earnings

Gross earnings of public utility enterprises in February, exclusive of telephone and telegraph companies, as reported to the Department of Commerce by ninety-five companies or systems operating gas, electric light, heat, power, traction and water services and comprising practically all of the important organizations in the United States, were $194,000,000, as compared with $203,000,000 in January, and $187,383,731 in February, 1928.

Developed Water Power

The United States Geological Survey has recently made public its annual compilation of the developed water power of the United States, as of the first of the current year. In its summary, the survey states:

"The total capacity of water wheels installed in water power plants of 100 horsepower or more in the United States on Jan. 1, 1929, was 13,571,530 horsepower, an increase of 1,275,530 horsepower, or 10.4 per cent, during 1928. The increase in 1927 was only 575,000 horsepower. The gain in 1928 was therefore more than twice that during 1927.

Electrical Equipment Market in Australia

Increasing German competition in electric household devices is tending to lower prices in Australia, according to Trade Commissioner E. C. Squire, Sydney. It is proposed to increase the duty on dishwashing machines to 60 per cent, effective April 1, unless deferred.

Japan a Diminishing Market for Batteries

Japan was formerly a fairly good market for American automobile storage batteries. However, within recent years a large domestic industry has been developed and the local manufacturers are now able to supply most of the requirements of that market. One company produces all types of storage batteries, and its annual production is valued at approximately Yen 10,000,000; another company of Kyoto is also a very large producer and supplies practically all of the requirements of the Japanese Army, Navy and Railway Bureau.

Radio in Roumania

A marked interest is being manifested in radio in Roumania, which is being stimulated by the erection of a temporary broadcasting station and the prospect of the completion during the coming spring of the powerful and well equipped station which has been reported before in this bulletin. American radio equipment is well liked in Roumania, and that country offers a constantly increasing market, which is well worth the attention of American manufacturers.

New Electric Power Plant in Honduras

A new electric power plant is under construction in Tela. The plant is to replace an old and obsolete one now in use. The plant is the only one in Tela and supplies practically the entire town with light. The current is alternating, 60 cycles, 110 volts. The entire equipment and materials used on the building are of American manufacture.

Output of Electrical Products Increases

The Department of Commerce announces that, according to data collected at the biennial census of manufacturers taken in 1928, the establishments engaged primarily in the manufacture of electrical machinery, apparatus and supplies in 1927 reported a total output valued at $1,637,307,035, an increase of 6.3 per cent as compared with $1,540,002,041 reported for 1925, the last preceding census year.

Industrial Machinery Exports Increase

Exports of industrial machinery during February continued the upward trend noticeable since 1922, totaling $19,562,000 or an increase of 30 per cent over the corresponding month of 1928.

Industrial Control Standards

These standards for industrial control apparatus include American Standards, Nema Adopted Standards, Recommended Practices and Suggested Standards for Future Design. The use of them results in greater uniformity and in improved quality of industrial control equipment

THE following article is the second in a series presenting the Industrial Control Standards of the National Electrical Manufacturers Association. This series forms a reference work of practical information concerning the manufacture, test and performance of industrial control equipment

Splash Proof Apparatus

120-100 (a) Splash proof apparatus is apparatus so constructed and protected that external splashing will not interfere with its successful operation.

American Standard—Approved 7-9-1925.

Water Tight Apparatus

120-101 (a) Water tight apparatus is apparatus so constructed that a stream of water from a hose (not less than 1 in. in diameter) under a head of about 35 ft. and from a distance of about 10 ft., can be played on the apparatus for several minutes without leakage.

American Standard—Approved 7-9-1925.

Weatherproof Apparatus

120-102 (a) Weatherproof apparatus is apparatus so constructed or protected that exposure to the weather will not interfere with its successful operation.

Adopted Standard 11-18-1916.
Adopted Standard 5-25-1925.

Sleet Proof Apparatus

120-103 (a) Sleet proof apparatus is apparatus so constructed or protected that the accumulation of sleet will not interfere with its successful operation. (See A. I. E. E. Rule 7072.)

Adopted Standard 6-13-1923.

Submersible Apparatus

120-104 (a) Submersible apparatus is apparatus so constructed that it will operate successfully when submerged in water under specified conditions of pressure and time.

American Standard—Approved 7-9-1925.

Gas Proof Apparatus

120-105 (a) Gas proof apparatus is apparatus so constructed or protected that the specified gas will not interfere with its successful operation.

American Standard—Approved 7-9-1925.

Gas Tight Apparatus

120-106 (a) Gas tight apparatus is apparatus so constructed that the specified gas will not enter the enclosing case under specified conditions of pressure.

American Standard—Approved 7-9-1925.

Moisture Resisting Apparatus

120-107 (a) Moisture resisting apparatus is apparatus so constructed or treated that it will not be readily injured by moisture. Such apparatus shall be capable of operating in a very humid atmosphere, such as that found in mines, evaporating rooms, etc.

American Standard—Approved 7-9-1925.

Acid Resisting Apparatus

120-108 (a) Acid resisting apparatus is apparatus so constructed that it will not be readily injured by acid fumes.

Adopted Standard 11-18-1916.

Fume Resisting Apparatus

120-109 (a) Fume resisting apparatus is apparatus so constructed that it will not be readily injured by the specified fumes.

American Standard—Approved 7-9-1925.

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Properties and Characteristics of Apparatus Cont.

120-100 Splash Proof Apparatus
120-101 Water Tight Apparatus
120-102 Weatherproof Apparatus
120-103 Sleet Proof Apparatus
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120-105 Gas Proof Apparatus
120-106 Gas Tight Apparatus
120-107 Moisture Resisting Apparatus
120-108 Acid Resisting Apparatus
120-109 Fume Resisting Apparatus
120-120 Wear Allowance
120-121 Break
120-122 Pick-Up Voltage (or Current)
120-123 Sealing Voltage (or Current)
120-124 Sealing Gap
120-125 Drop-Out Voltage (or Current)

Miscellaneous

120-130 Conducting Parts

Wear Allowance

120-120 (a) Wear allowance is the total thickness of material which may be worn away before the contact of two associated surfaces becomes ineffective.

American Standard—Approved 7-9-1925.

Break

120-121 (a) The break of a circuit opening device is the minimum distance between the stationary and movable contacts when these contacts are in the open position.

(1) The length of a single break is as defined above.
(2) The length of a double break (breaks in series) is the sum of the two breaks.
(3) The length of a quadruple break (breaks in series) is the sum of the four breaks.

Adopted Standard 5-27-1924.
Adopted Standard 1-15-1925.

Pick-Up Voltage (or Current)

120-122 (a) The pick-up voltage (or current) is the voltage (or current) at which a magnetic contactor starts to close under conditions of normal operating temperature.

American Standard—Approved 7-9-1925.

Sealing Voltage (or Current)

120-123 (a) The sealing voltage (or current) is the voltage (or current) necessary to seat the armature of a magnetic contactor from the position at which the contacts first touch each other, under conditions of normal operating temperature.

American Standard—Approved 7-9-1925.

Sealing Gap

120-124 (a) The sealing gap is the distance between the armature and the center of the core of a magnetic contactor when the contacts first touch each other.

Adopted Standard 6-7-1921.

Drop-Out Voltage (or Current)

120-125 (a) The drop-out voltage (or current) is the voltage (or current) at which the contacts of a magnetic contactor open under conditions of normal operating temperature.

American Standard—Approved 7-9-1925.

Miscellaneous

Conducting Parts

120-130 (a) Conducting parts of control apparatus are those designed to carry current or which are conductively connected therewith.

American Standard—Approved 4-25-1928.

Grounded Parts

120-131 (a) Grounded parts are those parts which are so connected that, when the installation is complete, they are in electrical connection with the earth.

American Standard—Approved 4-25-1928.

Magnet Brake

120-132 (a) A magnet brake is a friction brake controlled by electro-magnetic means.

American Standard—Approved 7-9-1925.

Jogging Service

120-133 (a) "Jogging" or "inching" is the quickly repeated closure of the circuit to start a motor from rest for the purpose of accomplishing small movements of the driven machine.

Adopted Standard 10-25-1927.

Control Circuit Transformer

120-134 (a) A control circuit transformer is a voltage transformer utilized to supply a voltage suitable for the operation of shunt coil magnetic devices.

American Standard—Approved 7-9-1925.

Controller Wiring Diagram

120-135 (a) A controller wiring diagram is a diagram showing the electrical connections between the parts comprising the controller, and indicating the external connections.

American Standard—Approved 7-9-1925.

External Controller Wiring Diagram

120-136 (a) An external controller wiring diagram is a diagram showing the electrical connections between the controller terminals and outside points; such as connections from the line, to the motor, and to auxiliary devices.

American Standard—Approved 7-9-1925.

Controller Construction Diagram

120-137 (a) A controller construction diagram is a diagram indicating the physical arrangement of parts such as wiring, buses, resistor units, etc.

Example: A diagram showing the arrangement of grids and terminals in a grid type resistor.

American Standard—Approved 7-9-1925.

Elementary Controller Diagram

120-138 (a) An elementary controller diagram is a diagram using symbols and an elementary plan of connections to illustrate, in simple form, the motor circuits and the scheme of control.

American Standard—Approved 7-9-1925.

Control Sequence Table

120-139 (a) A control sequence table is a table indicating the connecting devices which are closed for each successive position of the controller.

American Standard—Approved 7-9-1925.

Fuses

120-140 (a) A fuse is an over-current protective device with a circuit opening fusible member directly heated and destroyed by the current passing through it.

Adopted Standard 1-19-1927.

Thermal Cutout

120-141 (a) A thermal cutout is an over-current protective device that contains a heater element in addition to and affecting a fusible member which opens the circuit.

Adopted Standard 1-19-1927.

NOTE—The heater element may be a coil, a resistive conductor, or any heat producing means responding to the current.

Barrier

120-142 (a) A barrier is a partition for the insulation or isolation of electric circuits or electric arcs.

Adopted Standard 11-1-1922.

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120-500 Duty of Controller
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120-504 Periodic Duty
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120-507 Switching Devices Judged as Motor Controllers

Rating Performance and Test

120-508 Ambient Temperature
120-509 Rating
120-510 Expression of Rating
120-511 Resistor Rating

Duty and Service Classifications

Duty of a Controller

120-501 (a) The duty of a controller means the specific function or functions which it is designed to accomplish with respect to the operation of the motor; such as, starting, speed control, reversing and stopping; and, in addition, the frequency and length of time of operation.

American Standard—Approved 7-9-1925.

Continuous Duty

120-502 (a) Continuous duty is a requirement of service which demands operation at substantially constant load for an unlimited period.

American Standard—Approved 7-9-1925.

Intermittent Duty

120-503 (a) Intermittent duty is a requirement of operation or service consisting of alternate periods of load and rest so apportioned and regulated that the temperature rise at no time exceeds that specified for the particular class of apparatus under consideration.

Adopted Standard Revised 11-10-1915.

Periodic Duty

120-504 (a) Periodic duty is a requirement of service which demands operation for alternate periods of load and rest in which the load conditions are well defined and recurrent as to magnitude, duration and character.

American Standard—Approved 7-9-1925.

Varying Duty

120-505 (a) Varying duty is a requirement of operation or service in which the apparatus is called upon to run at loads, and for periods of time, which may be subject to wide variation, but which are in no case sufficient to cause the maximum temperature rating to be exceeded. In no case shall the no-load losses be sufficient to cause the maximum temperature rating to be exceeded in any part under no-load continuous operation.

Adopted Standard 5-20-1912.

Service of a Controller

120-506 (a) The service of a controller is the specific application in which the controller is to be used, as for example:

(1) General purpose, which covers the occasional starting of motors.
(2) Crane and Hoist.
(3) Elevator.
(4) Machine Tool, etc.

American Standard—Approved 7-9-1925.

Switching Devices Judged as Motor Controllers

120-507 (a) Any switching device having features intended for the starting and protection of motors shall be governed by the Industrial Control application rules.

Adopted Standard 5-27-1927.

NOTE—Knife switches arranged to cut out fuses during starting of the motor shall be governed by Industrial Control Application Rules.

Rating Performance and Test

Ambient Temperature

120-508 (a) Ambient temperature is the temperature of the air or water which, coming into contact with the heated parts of a machine, carries off their heat. (See A. I. E. E. Rule 3000.)

Adopted Standard 5-1-1916.

NOTE I—Ambient temperature is commonly known as "Room Temperature" in connection with air cooled apparatus not provided with artificial ventilation.

NOTE II—NEMA Rules specify that the standard ambient temperature of reference, when the cooling medium is air, shall be 40 deg. C.

Rating

120-509 (a) A rating of a machine, apparatus or device is an arbitrary designation of an operating limit.

NOTE I—A rating is arbitrary in the sense that it must necessarily be established by definite fixed standards and cannot, therefore, indicate the safe operating limit under all conditions that may occur in service.

(b) For the purpose of this section the rating of a controller is based upon the power governed, the duty and the service required. Standard ratings do not provide for overload capacity.

American Standard—Approved 7-9-1925.

120-510 (a) The rating of control apratus in general shall be expressed in volts, amperes, horsepower or kilowatts, as may be appropriate.

Adopted Standard 7-9-1925.

NOTE—For convenience in application, starters are frequently rated in horse-power. In such cases the starter rating is the horse-power rating of the largest motor for which the starter is designed to be used.

120-511 (a) Resistors shall be rated in

ohms and amperes and class of service.
American Standard—Approved 7-9-1925.

The various kinds of rating recognized are:

Continuous Rating

120-512 (a) The continuous rating defines the load which can be carried for an unlimited period, without causing any of the limitations established herein to be exceeded.
American Standard—Approved 7-9-1925.

Eight-hour Rating

120-513 (a) The eight-hour rating of a magnetic contactor is its ampere carrying capacity for eight hours under conditions of free ventilation starting with new, clean contact surfaces and not exceeding N. E. M. A. temperature limitations and with the operating coil circuit excited at full rated voltage.

(b) The eight-hour rating is the recognized standard rating. Any other time capacity required should be specified in definite terms.

NOTE—"Continuous Rating" with respect to contactors is considered as an indefinite term.

1 minute load every four minutes or ¼ time rating.

1½ minutes load every four minutes or ⅜ time rating.

2 minutes load every four minutes or ½ time rating.

In each case the alternate periods of load and rest shall be continued for one hour.

Service Classifications of Motor Control Resistors

120-517 (a) Numbers used to designate the resistors required for different classes of control service are given in Table 1.

(b) The test on starting and intermittent duty resistors to meet the above classification shall be continued for one hour. They are primarily designed for use with motors requiring an initial torque corresponding to the current value for the class of resistor specified and requiring an average (root-mean-square) accelerating current in any case of 125 per cent of full load value.

(c) The test on continuous duty resistors shall be continued until maximum temperature is reached. They shall be capable of carrying full load current on any point where the resistance will permit that amount of current to pass.
Recommended Practice 5-23-1919.
Recommended Practice 5-27-1926.

Table I—Classification of Resistors for Periodic Rating*

Approximate Per Cent of Full-load Current on the First Point	15 Sec. Out of 4 Min.	30 Sec. Out of 4 Min.	45 Sec. Out of 4 Min.	1 Min. Out of 4 Min.	1½ Min. Out of 4 Min.	2 Min. Out of 4 Min.	Continuous Duty
25	#11	#31	#41	#51	#61	#71	#91
50	#12	#32	#42	#52	#62	#72	#92
70	#13	#33	#43	#53	#63	#73	#93
100	#14	#34	#44	#54	#64	#74	#94
150	#15	#35	#45	#55	#65	#75	#95
200 or over	#16	#36	#46	#56	#66	#76	#96

American Standard—Approved 7-9-1925.

*Starting and intermittent duty resistors in the classification table are primarily designed for use with motors requiring an initial torque corresponding to the current value for the class of resistor specified and requiring an average (root-mean-square) accelerating current not in excess of 125 per cent of the full-load value.

120-514 (a) The service characteristics of contactors are recognized as determining their applicability to various duty cycles such as:

Maximum circuit closing capacity.

Maximum interrupting capacity.

Wearing qualities under given frequency of operation.

Adopted Standard 10-24-1927.

Periodic Rating

120-515 (a) The periodic rating defines the load which can be carried for the alternate periods of load and rest specified in the rating, the apparatus starting cold, and for the total time specified in the rating without causing any of the limitations established herein to be exceeded.
American Standard—Approved 7-9-1925.

Standard Periodic Ratings

120-516 (a) Standard periodic ratings are as follows:

15 seconds load every four minutes or 1/16 time rating.

30 seconds load every four minutes or ⅛ time rating.

45 seconds load every four minutes or 3/16 time rating.

Class 0 Insulation Defined

120-531 (a) Class 0 insulation consists of cotton, silk, paper and similar organic materials when neither impregnated* nor immersed in oil.
American Standard—Approved 4-25-1928.

†This applies to coils with a fiber or other similar insulating sleeve or collar for insulating the coil from the frame or core.

*Impregnated Cotton, Paper or Silk.—An insulation is considered to be "impregnated" when a suitable substance replaces the air between its fibers, even if this substance does not completely fill the spaces between the insulated conductors. The impregnating substance, in order to be considered suitable, must have good insulating properties, must entirely cover the fibers and render them adherent to each other and to the conductor, must not produce interstices within itself as a consequence of evaporation of the solvent or through any other cause, must not flow during the operation of the machine at full working load or at the temperature limit specified, must not unduly deteriorate under prolonged action of heat.

Class A Insulation Defined

120-532 (a) Class A insulation consists of cotton, silk, paper and similar organic materials when impregnated* or immersed in oil; also enamel as applied to conductors.
American Standard—Approved 4-25-1928.

Class B Insulation Defined

120-533 (a) Class B insulation consists of inorganic materials such as mica and asbestos in built-up form combined with binding substances. If Class A material is used in small quantities in conjunction for structural purposes only, the combined material may be considered as Class B, provided the electrical and mechanical properties of the insulated winding are not impaired by the application of the temperature permitted for Class B material. (The word "impair" is here used in the sense of causing any change which could disqualify the insulating material for continuous service.)
American Standard—Approved 4-25-1928

Class C Insulation Defined

120-534 (a) Class C insulation consists of inorganic materials such as pure mica, porcelain, quartz, etc.
American Standard—Approved 4-25-1928.

Standards Index for This Page

Rating Performance and Test Cont.

120-512 Continuous Rating
120-513 Eight-Hour Rating
120-514 Characteristics of Contactors
120-515 Periodic Rating
120-516 Standard Periodic Ratings
120-517 Service Classification of Motor Control Resistors
120-530 Temperature Limitations
120-531 Class O Insulation Defined
120-532 Class A Insulation Defined
120-533 Class B Insulation Defined
120-534 Class C Insulation Defined

120-530
Temperature Limitations

Table II

Item	Method of Temperature Determination	Limit of Observable Temperature Rise above Cooling Air			
		Class O Insulation (see par. 120-531)	Class A Insulation (see par. 120-532)	Class B Insulation (see par. 120-533)	Class C Insulation (see par. 120-534)
Wire Wound Coils..	Thermometer Method (see par. 120-535)	50° C.	65° C.	85° C	No limit specified
	Resistance Method (see par. 120-536)	70° C.	85° C.	105° C.	No limit specified
Single-layer series coils with exposed surfaces uninsulated or enameled.	Thermometer Method	..	90° C.†	..	No limit specified

Progress in Generator Design and Practice

*Following is the second installment of a series of articles treating with developments in the design and construction of electrical equipment**

IN the first of this series of articles, published in the April issue of ELECTRICAL MANUFACTURING, abstracts from statements made by the Allis-Chalmers Manufacturing Company and the American Brown-Boveri Electric Corporation, outlined new developments in the design and construction of electrical equipment for the year 1927-1928 by those companies respectively, while the following is abstracted from a similar statement made by the General Electric Company, as part of a report of the Electrical Apparatus Committee of the National Electrical Light Association, as prepared under the auspices of its Generating Stations Subcommittee.

It is estimated that 90 per cent of the salient-pole synchronous machines as now designed are made of structural steel.

There are several reasons for the recent tremendous increase in the use of structural steel and welding as a substitute for the use of castings. The cost of constructing patterns and the expense of storing them, the loss occasioned by defects in the castings, and the likelihood of failure in service as a result of internal strains, blowholes and the like, are some of the disadvantages of the old method of construction. They have long been appreciated by the industry and have been tolerated only because of the fear that some other form of structure would give rise to other troubles of even more serious nature.

With the development of flame cutting of steel plate and with the increased knowledge of the art of welding, however, the designers have become convinced that steel plate will not only eliminate casting defects but will also produce better mechanical structures. In fact, factory tests have demonstrated that the new method of construction eliminates the disadvantages of castings, and produces a structure superior in strength and reliability to the cast structure, and one more able safely to withstand the shocks of handling and the stress of short circuits.

The welded-plate stator construction, as applied to horizontal units, is illustrated in Figure 1. The side plates of horizontal units consist of segments cut from heavy rolled-steel plate, which are welded together by means of the hydrogen-enveloped arc. The use of this arc-welding process eliminates the necessity of scarfing the joints between segments and at the same time insures a ductile weld. The supporting feet of the units are cut out as part of the side plates, and a heavy foot plate is welded to these feet. The back plates are flame-cut, are rolled to the proper shape and are then welded to the side plates by an automatic arc-welding machine, which produces a practically perfect weld. The ribs for supporting the casting on which the stator laminations are stacked, are also welded to the side plates.

With reference to vertical units the first application of structural steel to the lower guide bearing was made in 1921, in the case of the 20,000-kv-a. generators built for the Alabama Power Company. Since that time practically all vertical waterwheel generators of large diameter have been furnished with structural-steel lower guide brackets. Figure 2 illustrates a typical lower guide bearing and bracket.

Standard rolled girder beams are employed in a design in which an upper-bearing bracket carries the thrust bear-

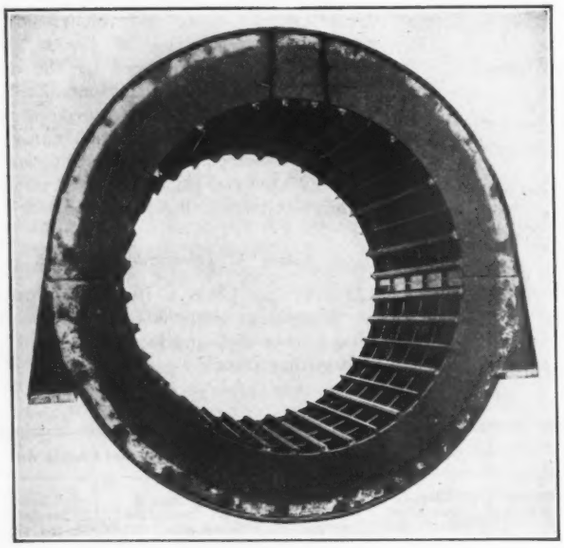


Figure 1

The welded plate stator construction as applied to horizontal units. The side plates consist of segments cut from rolled plate and welded together by means of the hydrogen-enveloped arc

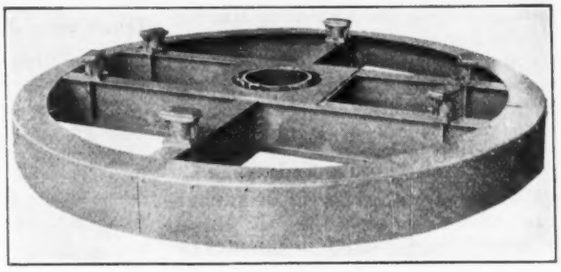


Figure 2

A typical General Electric lower bearing bracket of welded steel. The first application of this type was made in 1921 to some 20,000-kv-a. generators built for the Alabama Power Company

*Abstracted from a report of the Electrical Apparatus Committee of the National Electric Light Association, as prepared for the year 1927-1928, under the auspices of its Generating Stations Subcommittee.

ing for vertical waterwheel generators, and the appearance is improved by cutting off the ends of the beam in the form of an arc and by welding on a rolled plate. When load and span are such that rolled beams of the largest commercial size are not strong enough, the proper shapes are built up by welding together steel shapes of commercial sizes. The largest bracket of this type so far used supports a weight of 750,000 lb., in a 19,000-kv-a. generator recently sold to the Dixie Construction Company.

Practically the only cast frames which are used at the present time are for high-speed synchronous motors, in which it is possible to use the standard frames built on a quantity basis by the induction motor department.

The disadvantages of castings are of even greater importance when rotating elements are considered, especially those rotors which are subjected to high stresses from overspeed. As a result, structural-steel spiders of several types have been developed.

Spiders for small rotors have been built in considerable number of welded steel plate, one such spider being shown in Figure 3. The hub is flame-cut from thick steel plate or from shaft stock, and is welded to a center web also flame-cut from heavy plate or stock. The outside rim is of steel plate, rolled to the proper diameter and welded to the center web. This rim may be either of a single plate with arc-welded butt joints or of two plates completely welded together around the outer edges. Since the rim is welded to both both sides of the web plate around the complete periphery, the welded joint of the rim is not required to withstand the entire centrifugal force occasioned by the rotating of the poles.

Another design of rotor spider which eliminates the use of castings is the so-called laminated punched type. A spider of this design is shown in Figure 4, and it should be noted that such spiders can now be used in sizes up to 10 ft. in diameter, whereas the previous limit was about one-half this size. The ventilating openings and dove-tail slots for the fastening of pole pieces are all punched in advance by a press. Spiders of this type are usually built in sections, the laminations of each section being bolted together. This design has been used on machines of from five kv-a. to 100,000 kv-a. in capacity.

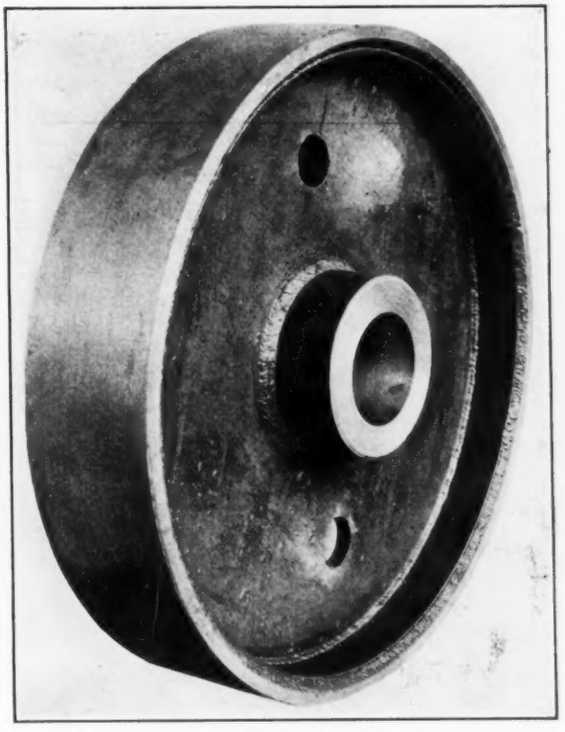


Figure 3

An alternator rotor spider of welded steel plate. The hub is cut from heavy plate or shaft stock and is welded to the center web, also cut from heavy plate or heavy steel stock

An entirely new development is represented by the rotor spider of the third general type. This spider has a free rim, made of segmental punched laminations mounted on a centering spider, which may be of either structural or cast construction. The laminated rim is not anchored to the centering spider, and therefore must carry all the centrifugal force occasioned by the rotating of the poles. Since the center has only to support the weight of the rim and of the poles, and to transmit the torque from the shaft, it is permissible to use cast material in this part of the structure. However, fabricated centers have been used in a number of machines, and it is expected that few cast centers will be used in future. This, the third type of spider, is shown in Figure 5.

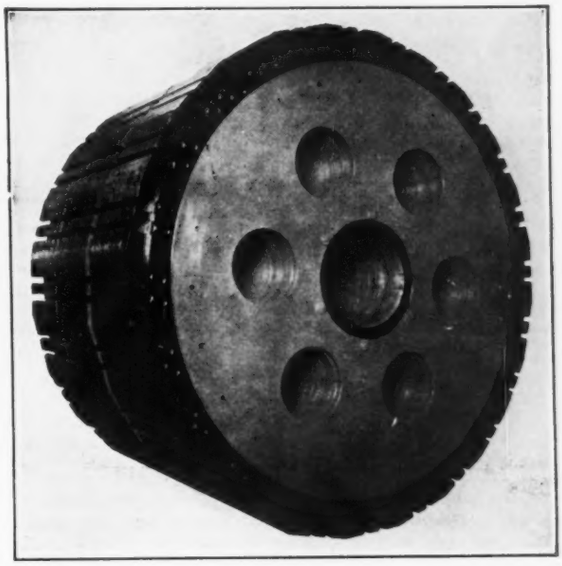


Figure 4

A laminated steel plate rotor spider for a 30,000-*kv-a. General Electric vertical water-wheel generator. Such spiders of this type can now be used in sizes up to ten feet in diameter*

Figure 6 shows the plate rim of a welded steel spider. The segmental bolted plates on the end serve as a support for the weight of the rim and of the poles, and also as a braking plate. The individual laminations, shown in Figure 7, are held in place by through-bolts in reamed holes, the bolts being so designed for shear and compression that the rim has the same strength as the plates. The holes of square cross-section around the periphery are intended to have inserted in them the coil springs, which are designed to support the field coils and to keep them tight regardless of insulation shrinkage.

Structural steel has been used in one way or another in a great many recent designs. The four 40,000-kv-a., 13,800-volt, 81.8-r.p.m. waterwheel generators for the Conowingo Station of the Philadelphia Electric system and the eight 12,550-kv-a., 14,000-volt, 100-r.p.m. waterwheel generators for the new hydro-electric station of the Louisville Gas & Electric system have their frames and lower-bearing brackets of structural steel. The three condensers recently sold to the Southern California Edison Company and rated at 50,000 kv-a., 13,200 volts and 600 r.p.m., have structural-steel frames, rotor spiders and ventilating shields, as has the 20,000-kw. frequency converter sold to the New England Power Company.

Almost all large turbo-generator frames are built of structural steel and are constructed from flame-cut boiler plate. A rib support is welded to the inside of the sup-

porting plate in order to secure sufficient surface for the bolting of the ribs. The ribs themselves are cut from steel plate and have machined surfaces, with a keyway left for supporting the punchings. On the outside of the circular

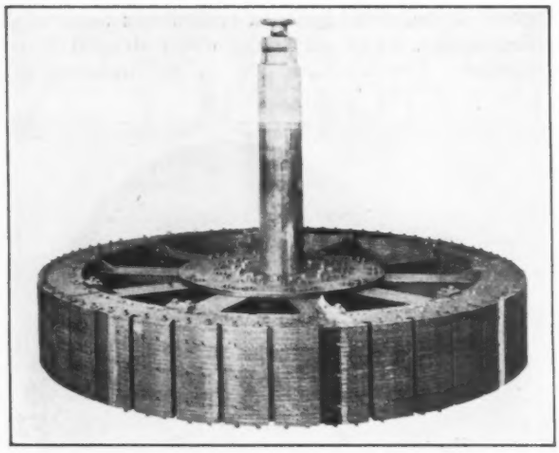


Figure 5

Another example of a structural steel spider having a free rim built for a 9,400-kv-a. General Electric vertical generator. In this construction the spider has a rim of punched laminations

supporting plates, which make up the sections of the units, there are welded ribs of steel plate for spacing and supporting the plates.

It is still the practice to cast out of non-magnetic steel the end flanges for large units. However, in the case of auxiliary generators and even in the case of some of the smaller main generators, the flanges have been made of steel plate. They have given very satisfactory service and

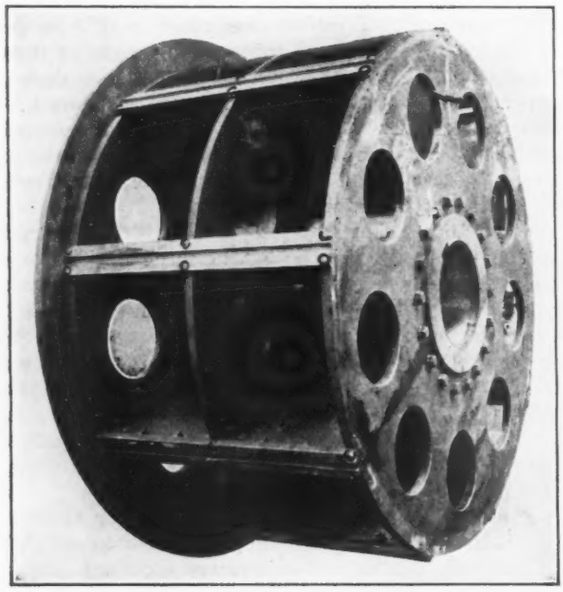


Figure 6

The plate rim of a welded steel spider. The segmental bolted plates on the end serve as a support for the weight of the rim and of the poles, and also as the breaking plate

there is, therefore, the possibility that plate flanges will be used in future on larger units.

On generators which are too large to ship with foot plates in place, the plates are made detachable, as are the steel-plate hoods covering the units. It is, therefore, possible completely to assemble the core and windings at the factory without exceeding shipping dimensions and weights. By constructing units in this manner, it is also possible to test them at the factory, such not having been the case with respect to large units in the past.

The outer shell for the large unit is also made of boiler plate and is rolled to fit the supporting plates of the unit. All the partitions are of steel plate, welded to the shell, an air-tight cover for the unit thereby resulting. Some of the large units which have recently been constructed of structural steel include the 100,000-kv-a., 0.9-power-factor, 16,500-volt, 1500-r.p.m. unit for the Southern California Edison Company; the 235,000-kv-a., 0.85-power-factor, 22,000-volt, 1800-r.p.m., cross-compound unit for the State Line Generating Company; the 187,000-kv-a., 0.85-power-factor, 11,000-volt, 1800-r.p.m., cross-compound unit for the American Gas & Electric Company, and the 160,000-kv-a., 1.0-power-factor, 11,400-volt, 1500-r.p.m. single unit for the New York Edison Company. The use of structural steel for the frames of the units mentioned above has resulted in the manufacture of stronger and lighter machines, and has made possible the shipment of the generators as assembled at the factory, with the exception of the New York unit.

The mechanical structure of direct-current generators, motors and synchronous converters has been changed considerably in the last year or two. All the magnet frames for these units are now made of rolled steel, in two parts. Each of these parts is rolled into the form of a semi-circle, and then bolted together to form the magnet frame. Feet for supporting the unit are welded on to this frame. Rolled frames have been made in diameters as large as 160 in., with a thickness of 9¾ in. and a width of 26 in. In fact, in the case of a steel-mill motor, the frames were of such size that it became necessary to weld together two of these rolled frames to secure the proper width of magnet frame.

The rolled construction for magnet frames was adopted as a means of securing better commutation of direct-current machines, since there was felt to be less likelihood of flaws than in castings. Test results and experience with the rolled frame have justified its use and have proved conclusively that better commutation has been effected.

(To be continued)

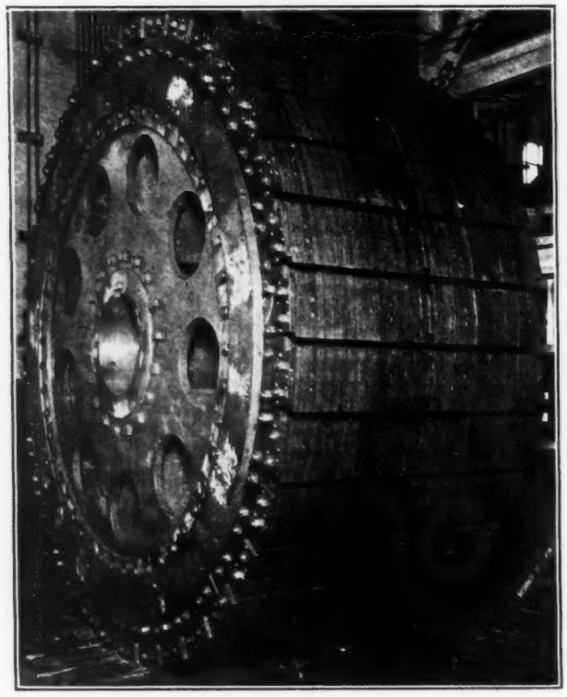


Figure 7

The individual laminations shown above are held in place by through bolts in reamed holes, the bolts being so designed for shear that the rim has the same strength as the plate

French Appliance Market

(*Continued from page* 40)

trict, where the great metal-furnaces yield up a gas by-product which may readily be used for gas-motor generating.

But in front of you, as you face south, the ground gradually slopes upward. Southeast are the Alps and Southwest, the Pyrennes. Between you and the mountains lies the great Massif Central or central plateau. And it is here, among the mountains and on the plateau, that water power development is fast taking place.

In the Alps region, the maximum water power is available in the summer because of melting snow, but at that time the Pyrennes rivers are at their lowest. However, in the winter when the Alps are frozen tight, the Pyrennes, which are not so high, are having their annual rains and the rivers are swollen. Therefore, by interconnecting the two districts, an abundant supply of hydro-electric power will be always available.

But this is not all! The Massif Central is to benefit from this supply of waterpower, being eventually hooked up with both the Alps and the Pyrennes districts, and together with existing thermal plants which are being enlarged and augmented, the power available in France will rival that of her electrically-rich little neighbor—Switzerland!

Already the demand for electrical appliances in this district of France is encouraging manufacturers to greater production. Central stations are bending efforts to get more appliances into use. Since power is abundant and rates are low, load-building is essential for doing a volume business.

Already we find that nearly all cooking and heating is done by power in these hydro-electric districts. The appliances are of the cheaper quality to be sure, and all from continental manufacturers, but the demand for a greater variety of devices is insistent. Miner craftsmen who for generations have whittled and burnished and bored by hand are now putting small motors to work at these tasks, and literature from recent agricultural expositions shows the electric fireless cooker in use in a peasant cottage while the womenfolk hoe in the fields!

Probably the one thing we need to keep uppermost in mind in connection with all this electrical expansion is the fact that nothing over here really happens in a hurry! The farther south in Europe you go, the more tranquil and leisurely is daily life. Not even in Paris where business is considered brisk, especially in those flush seasons when the American wallet is loose in the land, are electrical dealers snowed under with rush orders.

But the American manufacturer who can bring over a good product for which there is any place in the scheme of French living, put some money behind moving it and some patience behind that, will eventually ellicit, in his days of prosperity, that coveted comment that crowns all endeavor—"Oh, yes, he was one of the early birds who came over here first and got all the business!"

Selecting Bearings

(*Continued from page* 35)

6—Sleeve bearings are not easily destroyed by dirt or corrosion.	6—A small amount of dirt accidentally or carelessly admitted to a ball or roller bearing is sufficient to ruin it. These bearings must be protected from dirt as carefully as the works of a watch. The polished steel surface must always be covered with grease to prevent corrosion.
7—A dirty sleeve bearing is readily cleaned, and any small particles remaining will probably be washed out by the circulating oil and settle in the sediment chamber provided in modern sleeve bearing housings.	7—It is very difficult, if not impossible, to satisfactorily clean a ball or roller bearing which has become dirty. Small particles or abrasive dirt imbed themselves in the soft material of the retainer or separator, and lap down the balls to a smaller diameter, resulting in as much as 1/16-in. radial looseness in the bearing in certain actual cases. Washing in benzine rarely succeeds in dislodging these particles.
8—Sleeve bearing motors are more readily taken apart than ball bearing motors, the bearings remaining in and being removed with the brackets. Bearings, therefore, do not interfere with removal of collectors, commutators, etc., from the shaft.	8—Ball bearing motors require the removal of more bolts for disassembly than in the case of sleeve bearing motors. The bearings usually are pressed on to the shaft and locked in place with locking nuts. Nuts must be removed and pullers used to remove the bearing before it is possible to remove collectors, commutators, etc., from the shaft.
9—Sleeve bearings allow end play, avoiding wearing ridges on collectors and commutators.	9—Armatures of ball and roller bearing motors usually do not oscillate freely.
10—The thrust shoulders of sleeve bearings can absorb without injury the blows incident to driving on pinions and couplings.	10—Driving on of pinions or couplings is apt to ruin ball bearings unless the opposite end of the shaft is well supported, relieving the bearing of this severe thrust load.
11—Split sleeve bearings may readily be furnished in cases where it is necessary to remove bracket and bearing from the shaft without removing adjacent couplings, etc. Where two rotors are mounted on one shaft with a bearing between, a split bearing is the only solution.	11—Ball and roller bearings cannot be split as sleeve bearings are.
12—In general, the load capacity of sleeve bearings increases with the speed. Very large bearings carrying heavy loads at high speeds are, therefore, successfully made.	12—The load capacity of ball and roller bearings falls off rapidly with the speed. Very large bearings cannot, therefore, be run at very high speeds without great sacrifice in load-carrying capacity, and the combination of very large loads and very high speeds cannot be successfully handled by ball or roller bearings.

Ball and roller bearings have a number of points of advantage over sleeve bearings as given in the comparison following, and in certain cases these advantages become sufficiently important to outweigh the disadvantages enumerated above.

Advantages of Ball Bearings and Roller Bearings	Corresponding Disadvantages of Sleeve Bearings
1—Grease is successfully used as a lubricant for ball and roller bearings, which permits mounting of the motor in practically any position without escape of lubricant.	1—Oil lubrication is most satisfactory for sleeve bearings, with the consequence that permissible tilting of the motor is limited. Grease is not usually satisfactory as a lubricant.
2—Ball and roller bearing motors may be readily arranged to take large end thrust during operation. A single bearing can take axial and radial thrust at one and the same time.	2—The end thrust capacity of sleeve bearings while running is usually quite limited, an additional bearing being necessary to carry any considerable end thrust, as in vertical motors.

3—The starting friction of ball and roller bearings is relatively low and remains about the same for running speeds. This is a desirable feature on very slow moving shafts carrying heavy loads, or in the case of apparatus which is continually starting and stopping.	3—The starting friction of sleeve bearings is higher than the running friction, as the oil film between the bearing and the journal is not properly established until a certain speed is attained.
4—Ball bearings permit somewhat smaller overall length of motor except in special cases.	4—On account of the proportions of sleeve bearings, sleeve bearing motors are usually a little greater in overall length than ball bearing motors.
5—Ball bearings will run with very slight lubrication for a limited period.	5—Failure of proper lubrication of motor sleeve bearings will cause rapid failure.

It is sometimes asserted as an advantage of ball bearings over sleeve bearings that the former hold the air gap between the rotor and the stator better than sleeve bearings. This is not true with bearings equally well protected from dirt where speeds and loads are properly proportioned and on the other hand, there have been cases where, when a small quantity of abrasive dirt accidently got into ball bearings, the balls wore down as much as 1/32-in. in diameter in the course of a few months, allowing the rotor to drop 1/32-in. from its normal position.

Electrical Uses of Mica

(*Continued from page* 49)

bars. The third is heater plate, some of which comes in sheets measuring 36 by 36 inches, affording much economy in the cutting of shapes that would be out of question with natural sheet mica. For the insulation of armature cores and slots, field coils, transformers, etc., the market affords a variety of manufactured mica that does not require heat for bending to shape.

The manufacturer of a built-up mica, marketed under a proprietary trade name, furnishes in addition to plates, varying in thickness from 1/64 to 3 in. and measuring 36 by 36 in., rods with a maximum diameter of 3 in. and a maximum length of 36 in. In the manufacture of tubes this manufacturer uses special machinery and furnishes them with inside diameters ranging from 3/16 in. to as large as 36 in. Depending upon the inside diameter, lengths up to 90 in. can be supplied. Channels, angles, gears and special shapes can be furnished, being largely a matter of dies and molds for which in any but the very largest quantities, development charges are customary.

A good deal of manufactured mica is used in lighting fixtures. The material resembles parchment and lends itself admirably to the decorative effects now highly popular in lamp shades. The manufactured mica sheet is rolled on mandrels into the cylindrical or conical shapes required. In this use its translucency and heat-resistance are valued properties.

The system of classification of sheet mica, by sizes, is different in the United States, Canada, and India. The United States classification is as follows, the figures representing inches: Punch, circle, 1½ by 2, 2 by 2, 2 by 3, 3 by 4, 3 by 5, 4 by 6, 6 by 8, 8 by 10, and larger. For punch mica the uncut sheet must be of sufficient size to yield a circle 1½ inches in diameter if stained, and 1¼ inches if clear; circle mica should yield a disk nearly 2 inches in diameter. The size of the rectangle obtainable also forms the basis of the classification for Canadian or "amber" mica, but the sizes differ. Sizes used for the classification of Canadian sheet mica, in inches, are 1 by 1, 1 by 2, 1 by 3, 2 by 3, 2 by 4, 3 by 5, 4 by 6, and 5 by 8. The Indian classification is not based on the size of the rectangle obtainable but on the area of usable mica in the sheet, charts for that purpose being one of the indispensable "tools" of the mica trade. Standard price lists have been worked out for cut electrical sheet mica on the basis of the differentials in size, list prices being subject to discounts, much as is the custom in the flat glass market. In ground mica, fineness of mesh determines the price.

Accurate Radio Inspection

(*Continued from page* 37)

with a speaker must undergo a test for performance before being packed for shipment.

Probably the most unique feature of Kolster's inspection department is the fact that the work of all inspectors is carefully checked. It is generally well known in industry that in the case of inspectors performing the same operations day after day, some of them at times become somewhat lax in the performance of their tasks, just as do workmen in the various production operations. To eliminate such conditions and to insure that no defective part might slip by and get into a receiver a system of statistical records, filled in by the inspectors, is used to check their work.

In the case of coils or transformers, for example, they must function within certain fixed limits. Charts are made having a horizontal line as a base. Two vertical lines represent the minimum and maximum limits. Between these are other vertical lines representing points between the fixed limits. As each transformer or coil is tested its performance is marked on the vertical line corresponding to its ratio. At the end of a day the total number tested can be counted from the card and at the same time a comparison can be made as to the performance of the entire day's output. Moreover, these charts often indicate a necessity for changes in limits or in some instances changes in design or construction. Comparisons of charts over periods of time and comparative tests of inspected devices with these charts often bring to light much valuable information.

Even with all this care and watchfulness in manufacturing and assembling radio receivers and speakers some of them often contain hidden defects that cause trouble for the user. To care for such conditions Kolster trains and maintains in all important cities a corps of expert service men, who function through dealers and jobbers, but who report directly to the factory. So that in the event a defective set does get out of the factory, even after all of these most rigid and exacting tests and inspections, a Kolster man is on hand to correct any trouble.

Motor Repair Shop

(*Continued from page* 53)

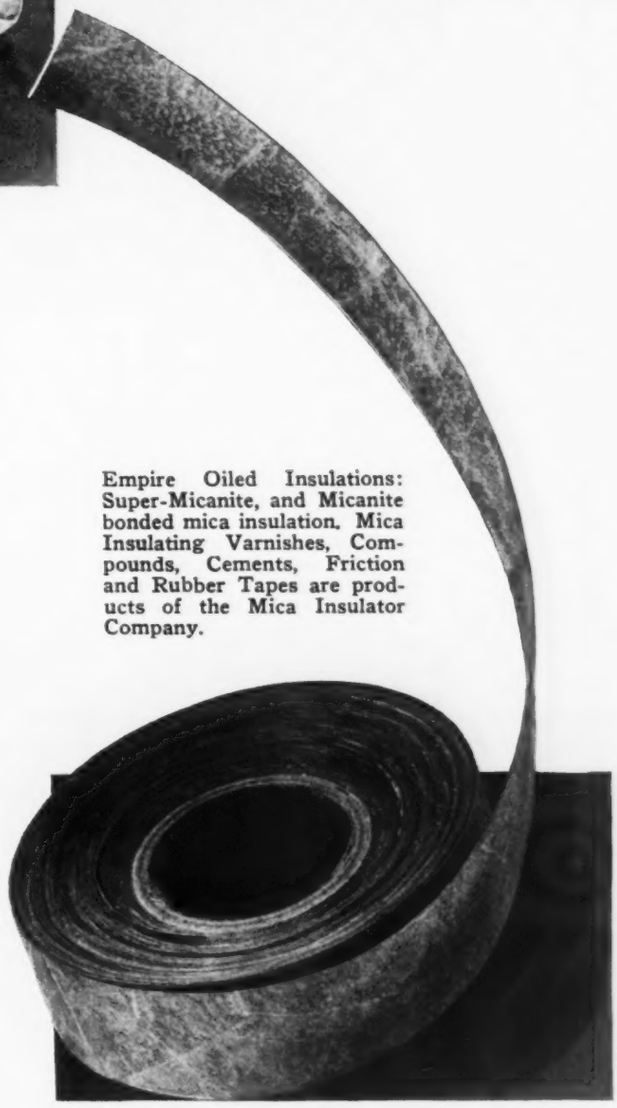
tion relative to labor and materials, as they were entered on repair work forms, 3 and 4.

Since careful records are kept of all materials and apparatus in stock or in the storage bay, two separate forms are required to withdraw either materials or stock apparatus for use. One of these is the material slip, which is really a requisition on the store-room for materials, while the other is the transfer order, or authority to withdraw apparatus from storage.

Two time cards are employed by the workmen. One is the customary "clock card" while the other is filled in by the employee with the number of the jobs on which he worked during the day, what he did, and how long in elapsed time the work required.

Another form used by Berger Brothers is the sale ticket. It is used only on apparatus resold and on its face

This *flexible* Super-Micanite *formed without applying heat*



Bend it when cold to fit an armature slot, a commutator core or field coil! No heat is necessary to form flexible Super-Micanite because of its special cement, of great flexibility and adhesivity.

Possessing great dielectric strength, flexible Super-Micanite can be used in thin sheets. Immersion in hot oil, up to 270° F., does not seriously affect its properties as an insulator for oil-cooled transformers.

In the form of tape, this flexible insulation makes a most efficient insulator for conducting wires and cables, possessing as it does high puncture voltage.

We will gladly send samples for test.

Empire Oiled Insulations: Super-Micanite, and Micanite bonded mica insulation. Mica Insulating Varnishes, Compounds, Cements, Friction and Rubber Tapes are products of the Mica Insulator Company.

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contains shipping directions, a description of the apparatus and such equipment in the way of pulleys, base, etc. The back contains a blank space for any remarks with provisions for entering conditions found after final test and inspection of the equipment.

Both Berger Brothers Electric Motors, Inc., and the F. W. Kiemle Company are headed by J. E. Berger as president, a man who has had some nine years of experience in the electrical industry. I. E. Goldman, with seven years experience in the buying and selling of electrical equipment, is vice-president of Berger Brothers, while F. W. Kiemle is vice-president and resident manager of the F. W. Kiemle Company. David Berger, engaged for nineteen years in the electrical business, is secretary and treasurer of the two organizations and Mr. Goldman functions as a director of the F. W. Kiemle Company.

Characteristics of Motors

(*Continued from page* 60)

varying speed motor will depend more upon the nature of the load during running conditions than simply the torque at starting, so that the amount of starting torque under less than full load conditions will not seriously effect the decision. It often happens that the application requiring heavy starting torque will also require heavy peak torque during running conditions. The series or compound wound motors would be the logical choice for such an application.

The torque that can be obtained from a shunt motor operating under adjustable speed conditions is greatest at the minimum speeds. The product of speed and torque is practically the same, whatever the speed, so that the motor has a constant horsepower rating over its operating speed range. It should be remembered here that the speed adjustments are obtained solely by shunt field rheostat control.

The shunt wound, adjustable speed armature shifting motor was illustrated in Figure 4. This type of motor develops a constant horsepower output over any range up to a 1 to 10 ratio of speed change.

Figure 10 shows the efficiencies and horsepower developed by a typical armature shifting, adjustable speed motor, for the high and low speeds within its operating range. It will be noticed that the efficiency is maintained fairly constant throughout the speed range and also that the horsepower developed remains practically constant through the same range. This comparison is made simply to show that this type of motor, while operating through a much wider speed range than the usual shunt motor, does not sacrifice operating characteristics to obtain the wider speed ranges.

(*To be continued*)

Measuring Instruments

(*Continued from page* 46)

of the chart travel from inches per hour to inches per second when an abnormal condition arises and it is desirable to obtain a detailed graphic record of it. Such a quick trip arrangement is made by the Esterline-Angus Company and shown in Figure 5.

Except for the motor attachment, the instrument is standard in every way. When conditions are normal, the clock drives the chart at slow speed. The small electric motor mounted on the side of the meter case runs continuously. Under normal conditions the motor shaft is disengaged. When abnormal conditions occur, and the operation of a relay energizes the electro-magnet, the worm on the motor shaft is brought into engagement, and the chart is instantly speeded up to 3600 times its normal rate of travel.

Since the instruments are intended to operate continuously, recording both normal and abnormal conditions, it is necessary that the chart be reset to the proper time of day, as soon as a disturbance ceases. To accomplish this the device is arranged so that once the rapid chart speed is started, it not only continues so long as the disturbance lasts, but long enough in addition to bring the chart to correct time, and then the slow chart speed is resumed. This resetting feature has additional advantages. It makes it possible to obtain high-speed records in locations where an attendant is not on duty. Disturbances sometimes follow each other in quick succession, and this device enables the instrument to record successive disturbances, with the record of each properly timed.

How the High-Speed Device Works.—The accompanying illustrations will show how this is accomplished. In Figure 5 is shown the meter and high-speed attachment with covers removed from the instrument and the quick trip device. The high-speed drive is coupled to the chart drive roll through an overrunning clutch, which permits the clock to drive the chart at slow speed.

By referring to the drawing of Figure 6, it will be noted that when the trip coil A is energized, the plunger B draws the mechanism pivoted at C downward, engaging the worm gear D with the worm E on the motor shaft, at the same time releasing the gear train from the safety lock F. Since the worm E is constantly in motion, power is immediately transferred through the gear train and flexible coupling and a roller clutch to the drive roll for the chart.

Resetting the Chart to Time.—If there were no resetting device, the chart would run at high speed so long as the spring M is held compressed by the plunger B, and slow-chart speed would be resumed as soon as the coil A was de-energized. This would of course throw the chart badly out of time. The disk H is geared to the train so that during the time it makes one revolution the meter uses a length of chart corresponding to twenty-four hours at slow-chart speed. In this disk is a notch in which the stop G engages. So long as the stop G is held out of the slot in the disk, the gears are held in engagement. When the stop enters the slot, the spring M is free to disengage the gears if the coil is no longer energized. Thus the only point at which the rapid feed can discontinue is at the end of the passage of the equivalent of twenty-four hours of chart.

When the coil is energized, the stop G is withdrawn from the slot and the gears thrown into engagement, and the train must continue to run until the coil is de-energized and the stop is opposite the slot. When the disturbance is over, the stop enters the slot in the disk at the instant they come opposite each other, and the spring M disengages the gears, stopping the train. If the plunger is still holding the stop out of engagement, the disk continues on a second revolution. In this manner, the device is made to run a twenty-four hour equivalent of chart length or a multiple of this length, in order to keep the chart approximately in time following a disturbance. Since it makes only one revolution in 24 seconds, the disk H moves slowly, and to make it impossible for the stop G to reengage the slot in case the coil is energized for only an instant, a second disk which is spring controlled, operates to close the slot instantly when the mechanism is tripped.

This equipment has proved to be extremely reliable and free from the necessity of attention. The motor is fitted with ball bearings; the electro-magnet has a wide range and will operate on voltages of from 90 to 140 volts either alternating 25 to 60 cycles, or direct current.

Since the high-speed device is an addition to a standard meter, it gives the user the advantage of having a combined high- and low-speed instrument for recording volts, A.C. and D.C.; amperes, A.C. and D.C.; kilowatts, A.C. and D.C.; K.V.A.; power factor, frequency, time, speed and pressure.

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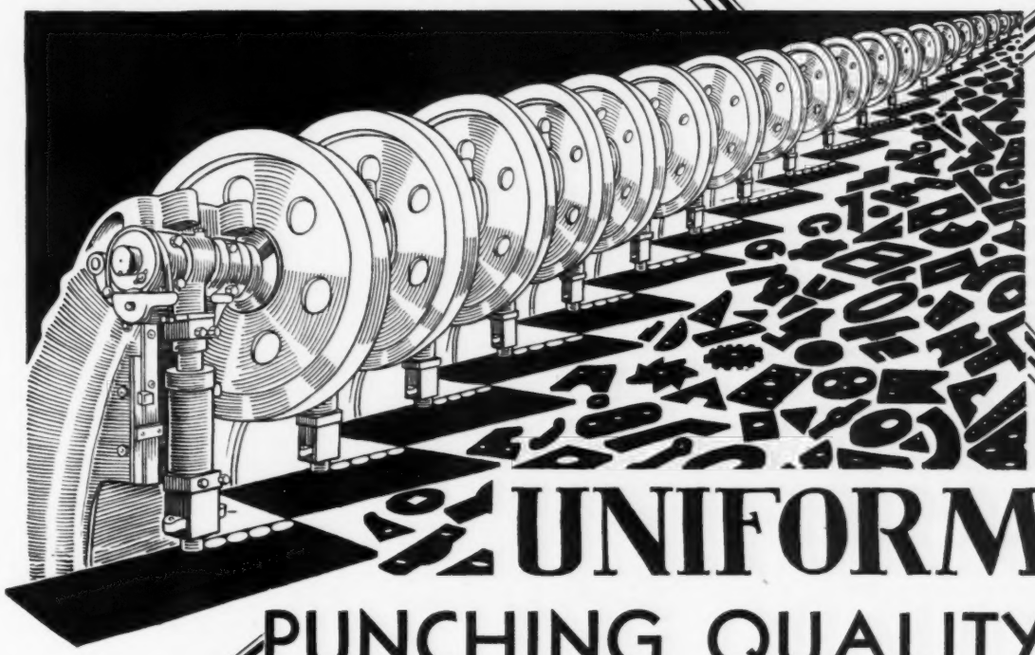

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Electrical Manufacturing News

A department containing news, and descriptions of new materials, parts and devices for the manufacture and repair of electrical products

Extensive Program Planned for Nema Sessions at Hot Springs, Va., May 18-25

Marketing, purchasing, unfair competition and price discrimination, cost accounting and policy relations will be among the principal topics discussed at the two general sessions of the Policies Division of the National Electrical Manufacturers Association to be held on May 18th and May 20 during the Spring meeting of that Association at Hot Springs, Va. The sessions of the Policies Division immediately precede the Spring meeting which will close on May 25.

Huntington B. Crouse, president, will address the first meeting on May 18 on the general subject of Nema. Other members will speak on various phases of policy relations with other organizations. These addresses will include one by W. E. Sprackling, vice-president in charge of the Nema Supply Division, on the National Electrical Code, and another on "Unfair Competition and Price Discrimination as Affected by the American Can Company Decision" by Harold Smith, general solicitor of the Westinghouse Electric and Manufacturing Company.

James L. Madden, third vice-president of the Metropolitan Life Insurance Company, will address the second general session on May 20th on "The Changing Scene in Marketing." Another subject of interest to the electrical manufacturing industry will be that taken by Edward T. Gushee, purchasing agent for the Detroit Edison Company. Mr. Gushee will talk on "Purchasing, Buying or Bargaining." Other speakers at this second meeting of the division will be Alfred E. Waller, who will discuss Nema from the viewpoint of the managing director and Thomas W. Howard, of the United States Chamber of Commerce, whose topic is "Some Possibilities of Cost Accounting." Following is the general program:

Saturday, May 18, forenoon, the following groups will meet: Organization Committee, Casualty & Fire Prevention Committee and Labor Committee. In the evening the Policies Division will hold its first session.

Monday, May 20, forenoon, the following groups will meet: Policies Division, Oil Circuit Breaker Group (Switchgear Section), Standards Committee; evening, Section Council.

Tuesday, May 21, forenoon, the following sections will meet: High Tension Fuse Group, Industrial Control, Electrical Mica, Mining & Industrial Locomotive, Motor & Generator, Power Switchboard Group, Refrigerator Transformer, Vulcanized Fibre, Wiring Devices, Code Committee and Cost Accounting Committee; evening, Air Circuit Breaker, Refrigerator, Department of Commerce Committee and Nominating Committee.

Wednesday, May 22, forenoon, the following sections will meet: Electric Measuring Instrument, Laminated Phenolic Products, Motor & Generator, Non-Metallic Conduit, Non-Metallic Sheathed Cable, Snap Switch and Switching Equipment Group. The dinner dance will take place at 7:00 p.m.

Thursday, May 23, forenoon, the following sections will meet: Attachment Plug, Industrial Control, Lamp Receptacle & Socket, Metal Molding, Motor & Generator, Panelboard & Distribution Board, Switchgear.

Friday, May 24, forenoon, the following sections will meet: Fuse, Industrial Lighting, Panelboard & Distribution Board.

Saturday, May 25, forenoon, meeting of Appliance Section.

Refrigeration Men Disband Council to Join Nema

Twelve of the leading electric refrigerator manufacturers, whose combined output is approximately 70 per cent of the industry's production, have voted to disband the Refrigeration Manufacturers Council and join the National Electrical Manufacturers Association as the Refrigeration Division. This reorganization, which is signaled by the manufacturers as the first step in an extension program of industry development, was unanimously sanctioned at a meeting of the Refrigeration Manufacturers Council, held in Detroit on April 16, at which representatives of the following companies were present:

T. K. Quinn

Absopure Refrigeration Corporation, Climax Electric Refrigerating Company, Copeland Products, Inc., Dole Refrigerating Machine Company, General Electric Company, Holmes Products, Inc., Kelvinator Corporation, Norge Corporation, Peerless Ice Machine Company, Servel, Inc., Universal Cooler Corporation and Westinghouse Electric & Manufacturing Company.

T. K. Quinn, manager of the electric refrigerator department of the General Electric Company, has been appointed chairman of the new Nema Refrigeration Division which will be divided into Domestic Refrigeration and Commercial Refrigeration Sections. George W. Mason, chairman of the board and president of the Kelvinator Corporation, will head the former Section while John D. Hallowell, of the Dole Refrigerating Machine Company, will serve as chairman of the latter group. The next meeting of the division will be held during the Spring meeting of the Association at Hot Springs, Va., May 21.

Extensive Food Preservation Program Is Endorsed

The unanimous endorsement of the national food preservation activity developed by the Refrigeration Committee of the National Electric Light Association was one of the outstanding developments of the meeting held in Detroit, April 15, at which the Refrigeration Manufacturers Council voted to disband and join the National Electrical Manufacturers Association as the Refrigeration Division. The food preservation activity involves a cooperative educational program in which all organizations interested in protection to health will be invited to participate.

Following the outline of plans for the food preservation activity, the refrigeration men present at the meeting pledged a subscription of $175,000 toward the fund. The program calls for national and local advertising, magazine and newspaper articles, radio talks, billboard posters, window displays, local addresses and other forms of publicity largely concentrated during the month of September.

Fraudulent Advertising Irks Sunshine Lamp Makers

Manufacturers of carbon arc lamps, better known as "sunshine" lamps, recently organized as a section of the National Electrical Manufacturers Association, have taken action looking toward the protection of the public against fraudulent or misleading claims in advertising.

In a resolution just adopted by the Carbon Arc Lamp Section of Nema it is stated that "in advertising and printed matter dealing with carbon arc lamps for sale to the public, curative claims shall be limited to building health to higher levels and as an aid in preventing common systemic disturbances."

These lamps employ the type A carbon and duplicate sunshine. The resolution passed by the section is designed to discourage self-diagnosis and establish the

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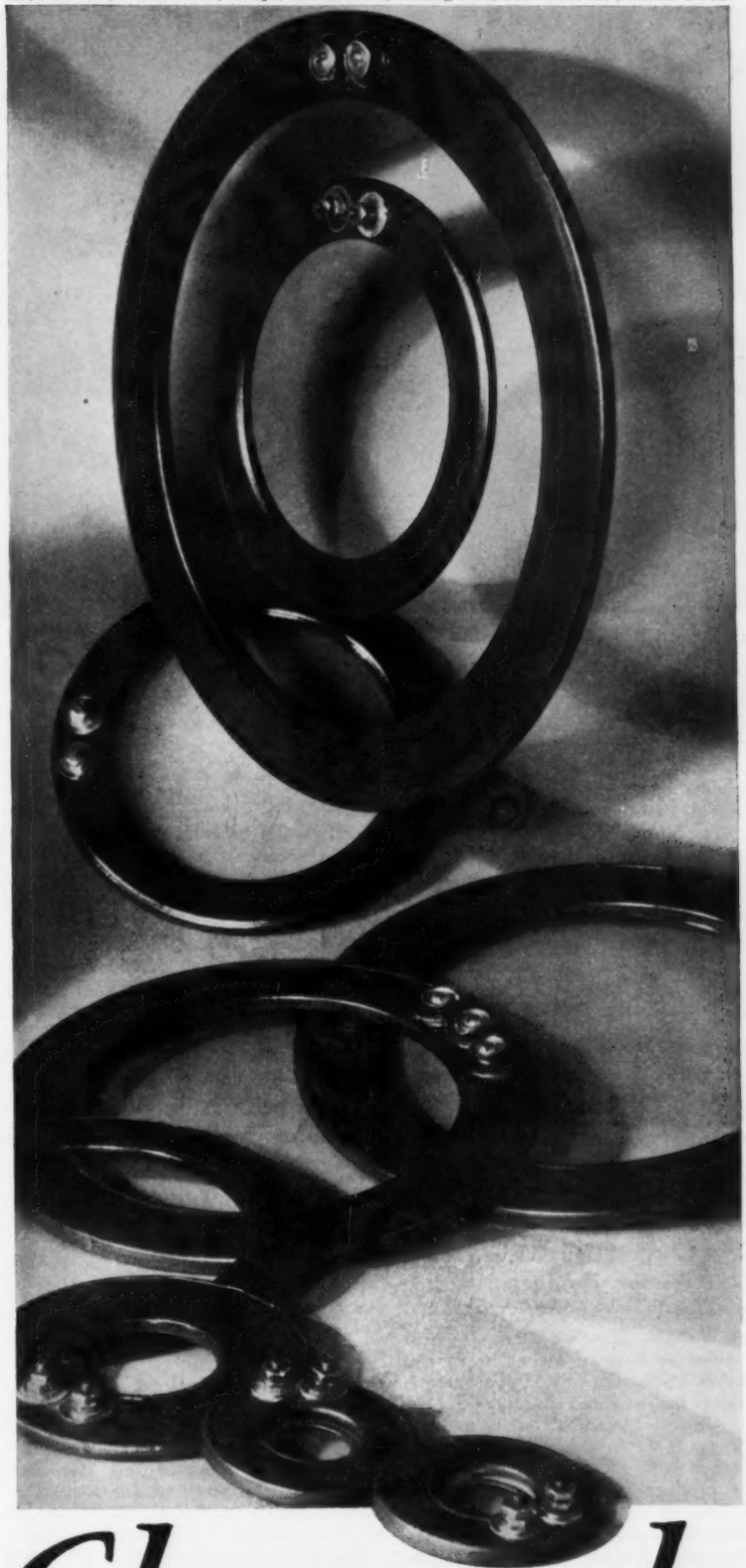

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Over 60 far-sighted manufacturers are doing it. Tests and experiments soon showed that it's more economical all around to equip products with patented Chromalox heating units.

IT'S like building an automobile . . . or a fine watch. The motor, the works, the insides must be right or it won't go. You are making appliances. Fine looking . . . latest designs . . . destined to be best-sellers.

The most important part of your product is out of sight

But what about the heating units that are out of sight and yet responsible for the every day successful operation of that waffle baker or electric range or water heater? Are they going to deliver the right heat everytime the switch is turned on?

Not a single burn-out in 58,000 heaters

That report just comes from an ironing machine manufacturer. It's his five-year experience with Chromalox heaters. Other companies report similar satisfactory operating records. Your own products can be made just as trouble-free by using these patented Chromalox units.

Start now to make your products trouble-free

Customers call us in to show them the right way to build in the heating units. Result, assembly costs are lowered, trouble is side-tracked. Whether you are working on a new product or improving an old one, tell us about the appliances or heating devices you want properly heated. There's no obligation!

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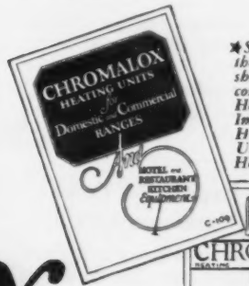

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thought that, in the treatment of specific diseases, carbon arc lamps should be used with the advice of a physician.

G. P. Rogers Leaves A. L. E. A. to Head Steel Society

Granville P. Rogers, managing director of the Artistic Lighting Equipment Association, has tendered his resignation to the officers and directors of the association. Mr. Rogers' new work involves the direction of the affairs of the Steel Founders Society of America.

No official action has been taken as yet by the board of directors on Mr. Rogers' resignation. The move will be taken up at the A. L. E. A. convention, in Atlantic City, June 3-8.

Management Problems Discussed at Two-Day Meeting

Management problems of interest to the metal-working and other industries were discussed at the Spring meeting of the Taylor Society, held May 1 and 2 at Charlotte, N. C. A general perspective session was conducted the morning of the first day, covering budgets, schedules and market analysis. The afternoon was taken up with the presentation of a number of papers on the major problems of sales and production management. Equipment control, materials control, process control and the problem of training personnel were among the subjects included.

The second day was taken up with round table conferences on the selection and training of workers, the control of operation, the maintenance of equipment and retail store management. There were also discussions on time study and rate study and the keeping of accounting and statistical records.

Electrical Exports Rise During First Quarter

Electrical exports from the United States for the three months ended March 31, 1929, amounted to $35,719,342 as compared with $25,548,648 for the same period of 1928, according to the Bureau of Foreign and Domestic Commerce, Department of Commerce. A rise in exports for the month of March, 1929, when the figures totaled $14,337,158 was reported, against $9,675,491 for March, 1928.

In the list of destinations for American electrical exports for March, 1929, Canada stands first, total, $3,330,621; second, United Kingdom, total, $1,053,144; third, Argentina, $1,010,498; fourth, Brazil, total, $682,607.

International Exposition Draws American Manufacturers

Electrical interests will be widely represented at the Barcelona International Exhibition which opens May 15 under the auspices of the King of Spain and Spain's leading industrialists.

American manufacturers of electrical tools, equipment and supplies have reserved 250 square meters of space in the palaces of Construction, Chemical Industries and Motion Pictures in the great industrial zone of the exhibition, according to M. Ventura, official delegate to this country from Barcelona. Included among exhibitors are the Arrow-Hart & Hegeman Electric Company, Hartford, Conn.; Black & Decker Manufacturing Company, Towson, Md.; Chicago Pneumatic Tool Company, New York; Foldex Electric Heating Company, Detroit, Mich.; Gilby Wire Company, Newark, N. J.; Hisey-Wolf Machine Company, Cincinnati; Jewell Electrical Instrument Company, Chicago; Lightolier Company, New York; Shepherd Electric Crane & Hoist Company, New York; Wellington J. Smith Company, Cleveland; Wiremold Company, Hartford, Conn.

When Darkness Comes and Shadows Fall

THE camera from its point of vantage in the Tribune Tower, Chicago, gazes out into the night to catch a view of the gorgeous fairyland which presents itself. The thousands of brilliantly lighted windows in the imposing structures which dot Michigan Boulevard and Wacker Drive shine forth to produce a blazing panorama

New Corporation Will Make Victor Products

The manufacturing activities of the Victor Talking Machine Company are to be taken over at an early date by the Audio Vision Appliance Company, which has been incorporated in New Jersey by the General Electric Company and the Westinghouse Electric and Manufacturing Company.

The products of the new company, which will be radio receiving sets, combination radio and electric talking machines, Orthophonic Victrolas, Radio-Victor Corporation of America portable Victrolas and records and appliances will be distributed through the recently organized Radio-Victor Corporation of America.

It is expected that the Victor Talking Machine Company will be dissolved eventually and that its outstanding preferred stock will be called about June 1.

Edward E. Shumaker, president of the Victor company, has been elected president of the new company, and Alfred Weiland has been elected vice-president, the same post he held with the Victor organization. Mr. Shumaker will be general manager and Mr. Weiland works manager of the new company. The other officers are H. P. Davis, chairman of the board; E. K. MacEwan, secretary; E. F. Haines, treasurer, and P. G. McCollum, controller.

Tubular Woven Fabrics Joins Anaconda Wire Group

Tubular Woven Fabrics Company, Pawtucket, R. I., manufacturer of Durabilt products, and the Maring Wire Company, Muskegon, Mich., have joined the group of wire and cable manufacturers making up the recently formed Anaconda Wire and Cable Company, Pawtucket, R. I.

Brunswick-Balke-Collender Purchases Bremer-Tully

The recently announced purchase of the Bremer-Tully Manufacturing Company, Chicago, capital stock by the Brunswick-Balke-Collender Company, places the former in a most advantageous position, says a Bremer-Tully announcement. The support of tremendous resources of almost every kind, including an additional engineering staff, wood and metal production facilities backed by 84 years of manufacturing experience, will considerably enhance the position of Bremer-Tully in its industry. These factors will insure the in-

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The opportunity of working with your technical staff in determining:

1. In what soldering, brazing or welding operations the use of "Handy" Silver Solders will save time or money—or produce a better product.
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What Is Silver Solder?

It is a combination of silver with copper—and, in most formulas, also with zinc.

The silver content ranges from 10% up to 80%. Strictly speaking, it is not a solder, but a brazing or welding material, because the parts to be joined must be brought up to almost a welding heat (1325° F. to 1600° F., depending upon the silver content).

Characteristics of Handy Silver Solder

1. **High tensile strength** of joints (40,000 to 60,000 lbs. per sq. in.) usually stronger than metals joined.
2. **Resistance to vibration and shock.**
3. **Resistance to operating temperatures** of 1400 to 1600 deg. Fahr.
4. **Resistance to corrosion** from either acid or alkaline enemies, or from the atmosphere.
5. **High electrical conductivity.**
6. **Penetration.** Flows freely, speeding up production. So small a quantity is required that the solder cost per joint is negligible.
7. **Makes neat, compact joints.**
8. **Color-match.** Colors range from that of sterling silver to that of yellow brass—according to formula.
9. **Accuracy to analysis,** gauge and width.

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creased production program which will be launched this year.

J. C. Tully and H. A. Bremer have retired from the business, and R. T. Pierson, has been elected president, with R. E. Smiley vice-president in charge of sales. Messrs, Pierson and Smiley will supervise the Bremer-Tully manufacturing and marketing policies as the company will retain its separate identity, without any change in the general methods of distributing its products. It is expected that the new Bremer-Tully line will be announced in the near future.

Assistant Manager Appointed for G. E. Publicity

Clifford W. Stuart, assistant to the manager of the publicity department of the General Electric Company since 1926, has been appointed assistant manager of the department, according to an announcement by Martin P. Rice, manager.

Clifford W. Stuart

Mr. Stuart is a native of Chesaning, Mich. In 1922 he was graduated from the University of Michigan in the business administration course. That same year he entered the employ of the International General Electric Company in the accounting department. In 1923 he was transferred to the accounting department of the General Electric Company and became a traveling auditor, a position he held until named assistant to the manager of the publicity department in 1926.

Hoist Division Established by Robbins & Meyers

A complete new line of improved electric and hand power cranes, hoists and trolleys up to 10-ton capacity is announced by Robbins & Meyers, Inc., manufacturer of electric motors, motor-generator sets and electric fans. The executive, technical and sales personnel of the new division were all formerly associated with the Chisholm-Moore Manufacturing Company of Cleveland in similar capacities.

Frank F. Seaman, who has been appointed general manager of the Robbins & Meyers crane and hoist division, is prominent among electric hoist men. Since 1902 he has been engaged continuously in the design, manufacture and sale of hoisting machinery with the Sprague Electric Works, Yale & Towne, Toledo Bridge & Crane Company, Euclid Crane & Hoist Company and Chisholm-Moore.

March Copper Output Soars to World Record

World copper production totaled 192,792 short tons in March, 1929, a record output, against 167,090 tons in February, 178,378 in January of this year and 147,842 tons in March, 1928. The best previous monthly production was in November 1928, 183,813 tons.

Delta-Star Electric Expands Distribution Facilities

Delta-Star Electric Company, 2400 Block Fulton Street, Chicago, announces the following additions to its distribution facilities:

Champion Switch Company has been purchased and the Kenova, W. Va., plant will continue manufacturing its present line of equipment in addition to several new designs. Manufacturing arrangements have been completed with the Société D'Installations et de Constructions Electriques et Mecaniques, Boulogne-sur-Seine, to manufacture and distribute Delta-Star equipment in France and its colonies. An interest has been acquired in the Monarch Electric Ltd., St. John, Quebec, which will soon be operated as the Monarch Delta-Star Company. At the Canadian factory will be manufactured a complete line of Delta-Star equipment, in addition to the present switching equipment, switchboards, oil circuit breakers and oil switches. New designs of large capacity breakers for voltages up to 132 kv. will be added in a very short time.

General Electric Orders Rise During First Quarter

Orders received by the General Electric Company for the first quarter of 1929 amounted to $101,365,208, compared with $79,925,840 for the corresponding three months of last year, an increase of 27 per cent, according to Gerard Swope, president of the Company.

Brevities

Dumore Company, Racine, Wis., is the new name for the Wisconsin Electric Company, manufacturer of electric drink mixers, motors, generators and portable tools. There is no change in the company personnel.

Roller-Smith Company, 233 Broadway, New York City, has appointed J. C. McDougall, Alaska Building, Seattle, Wash., as its district sales agent for Washington, Oregon and Alaska. Carl P. Lohr, 401 National Bank of Commerce Building, St. Louis, has been named district sales agent for the St. Louis territory.

Pittsburgh Reflector Company, has moved its New York office from 145 W. 41st St. to General Motors Building, Broadway and 57th St., New York City.

Hytron Corporation, Salem, Mass., vacuum tube manufacturer, has moved to its new factory and offices at New Derby and Lafayette Sts., Salem Mass.

Joseph Myerson, 411 Atlantic Ave., Boston, and the Karl Andren Company, formerly at 250 Congress St., Boston, have consolidated, with offices, shop and warehouse at 411 Atlantic Ave. The company is known as Andren-Myerson Company and buys, sells, rents and repairs electric motors and equipment.

Standard Wire & Tube Company is the new name for American Tube & Pipe Bending Company, Mineral Ridge, Ohio. The company's New York stock is now located at 90-92 Park Place, New York City.

Sonatron Tube Company, 1020 S. Central Avenue, Chicago, has named D. J. Quinn, formerly Western sales manager, as vice-president in charge of sales. Nathan Chirelstein was recently elected chairman of the board, and Harry Chirelstein, president. R. L. Marshall, office manager of the Chicago office and warehousing supervisor, has been made secretary of the company.

F. R. Zierick Machine Works, manufacturer of small stampings and wire terminals, until recently located at 6 Howard Street, New York City, is now located at 68-72 E. 131st St., New York City.

Superior Electric Products Corporation, 1300-1310 S. Thirteenth St., St. Louis, electric appliance manufacturer, has opened an Eastern office at 200 Fifth Ave., New York City, with Adolph W. Stern in charge. In addition to the main office in St. Louis, the company maintains the following Western representatives: Coast Distributing Company, 81 Madison St., Seattle, covering Washington; Eckert Lloyd Corporation, 770 Mission St., San Francisco and 1001 E. First, Los Angeles, covering California territory.

Thomas E. Murray, Inc., designing and consulting engineer, 88 Lexington Ave., New York City, has opened a branch office at 2702 Eaton Tower, Detroit, Mich. G. H. Kuechler is in charge of the office.

The Miller Company, Meriden, Conn., announces that its New York office and showroom is now located at 24 W. Fortieth St., New York City, where a complete display of the Miller line is on view.

Gotham Engineering and Sales Company, 50 Church St., New York City, has been appointed national sales representative for the products of Transcontinental Coil, Inc., Newark, N. J.

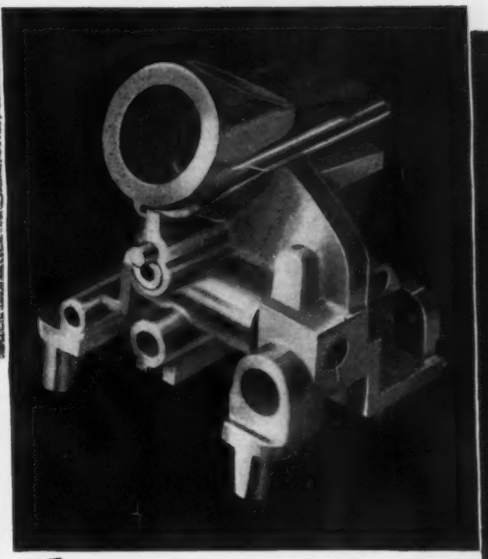
Mica Products Company, has moved from 101 Spring St., to 54 Greene St., New York City.

Westinghouse Electric & Manufacturing Company has appointed W. C. Evans superintendent of radio operations of the company, according to H. P. Davis, vice-president. Mr. Evans, who is 31 years of age, entered the broadcasting field in 1921 when he came to station KYW, Chicago, as an operator. He held the position of manager of that station when he left in 1928 to superintend relations between Westinghouse and R. C. A. in New York City. About a month ago he was transferred to East Pittsburgh.

Synthane Corporation has swung into full production at its new plant at Oaks, Montgomery County, Pa. The plant which was especially built for the manufacture of laminated Bakelite has been equipped with special machinery throughout and scientifically controlled processes are planned to keep the product uniform in all respects.

Williams Oil-O-Matic Heating Corporation, Bloomington, Ill., will conduct its fifth international convention at

An unusually complicated piece accurately and economically produced by Stewart Die Casting Process.



Production reduced to its simplest form

Die Cast by Stewart

Many complicated parts which would not be economically possible with other methods of production are delivered in quantity accurately, and at moderate cost, by Stewart Die Casting Service.

Stewart Die Castings produce as a single unit what would otherwise be a complicated assembly, maintain close tolerances in routine production, give smooth finish, adequate strength, light weight, and many other detail advantages.

The Stewart engineering staff offers practical information on the advantages of the die casting process as applied to any individual manufacturing requirements.

Stewart

THE STEWART DIE CASTING CORPORATION

4500 Fullerton Avenue CHICAGO, ILLINOIS

Detroit - Pittsburgh - Dayton - St. Louis - Newark - Cleveland

EM 5-Gray

Bloomington, Ill., June 3 and 4. About 3000 are expected to attend the meeting, an increase over last year's record attendance of 2700. The sessions will be held in a newly completed building, the final unit of the construction program inaugurated in 1924.

Cutler-Hammer, Inc., Milwaukee, Wis., announces the establishment of a warehouse at Cleveland, Ohio, in order to serve the increased trade in the East Central States. The company has leased 1600 sq. ft. of floor space for the storage of quick deliveries, while a complete line of standard motor control equipment and wiring devices will be available for immediate shipment. The territories to be served by these new facilities include Ohio, West Virginia, western New York and Pennsylvania, the province of Ontario and sections of Maryland, Indiana, Tennessee and Kentucky.

Johns-Manville Corporation, New York City, has moved its Western division headquarters from S. Michigan Ave. and 18th St. to 230 N. Michigan Ave., Chicago.

Kolster Radio Corporation announces that at a recent meeting held in Wilmington, Del., the company's directors were reelected. They are: Rudolph Spreckels, chairman, R. O. Bokee, Herbert H. Frost, Frederick Dietrich, Frank H. Hitchcock, M. C. Rypinski, Robert Hays Smith, Howard Spreckels and Ellery W. Stone.

H. P. Preis & Company, has moved from Newark, N. J., to 227 Fulton St., New York City.

Pacific Electric Manufacturing Corporation, San Francisco, has opened a branch assembling plant and warehouse at Gary, Ind. All products sold east of the Mississippi will be handled from this office. The plant will be under the supervision of E. S. Kessler, formerly executive engineer at the San Francisco plant, while C. F. Lamont will supervise sales in the Gary office.

Meadows Manufacturing Company, Bloomington, Ill., has completed the installation of $75,000 worth of new machinery to take care of increased production of the new "Select-A-Speed" washer. Production work is being carried on 22 hours a day and the company's force has been increased to 400.

Dudlo Manufacturing Corporation, Fort Wayne, Ind., division of General Cable Corporation, has consolidated its New York office with that of the General Cable Corporation at 420 Lexington Ave., New York City. The company's New York representatives are F. H. Phillips and P. E. Stouffer.

Air-Way Electric Appliance Corporation, Toledo, Ohio, announces the removal of its New York City office from 455 Seventh Ave., to newer and larger quarters at 205 East 42nd St.

Impervious Varnish Company, 421 Wood St., Pittsburgh, Pa., has moved its general and executive offices to the Koppers Building, 436 Seventh Ave., Pittsburgh.

Allen-Bradley Company, Milwaukee, Wis., has appointed John McC. Price district manager of the Chicago office, 500 N. Dearborn St. He was formerly district manager for the Industrial Company in the same territory. The Allen-Bradley Company has established a district office in Atlanta, with C. G. Moore in charge of the office, 101 Marietta St.

Kellogg Switchboard & Supply Company, Chicago, has appointed William J. Leighner as works manager. He has been identified with the electrical manufacturing industry for the past 26 years, the last six of which he spent as works manager of the Westinghouse plants at South Bend, Ind., Milwaukee, St. Louis and Valdosta, Ga.

Johns-Manville Corporation, New York City, has acquired the United States and Canadian rights to manufacture and sell Transite pipe, a seamless pipe made of asbestos and cement.

Utah Copper Company, reports net profit of $24,876,246 for the year ended Dec. 31, 1928. After payment of $12,995,920 in dividends, surplus was $11,880,326, as compared with surplus of $4,840,092 the previous year.

Becker Brothers Electrical Corporation, is the successor to Becker Brothers, Inc., 23-25 N. Jefferson St., Chicago, manufacturer of carbon graphite metal.

Baker-Raulang Company has elected A. J. Gates vice-president. His promotion follows closely his appointment as director of sales of the company's industrial truck division as announced last December. He is a graduate of Purdue University and for nine years was associated with the General Electric Company as sales engineer.

Kester Solder Company is the new name for the Chicago Solder Company, 4210 Wrightwood Ave., Chicago. There is no change in the company's personnel.

Coming Conventions

American Institute of Electrical Engineers. — Regional meeting at Swampscott, Mass., June 24-29.

American Society of Mechanical Engineers.—Regional meeting at Salt Lake City, Utah, July 1-4.

American Society for Testing Materials.—Annual meeting at the Chalfonte-Haddon Hall, Atlantic City, N. J., June 24-28.

Artistic Lighting Equipment Association.—Midsummer convention at Hotel Chelsea, Atlantic City, N. J., June 5-8.

Institute of Radio Engineers.—Annual meeting at the Mayflower Hotel, Washington, D. C., May 13-15.

National Association of Purchasing Agents.—Fourteenth Annual International Convention, Buffalo, N. Y., June 3-6.

National Electric Light Association.—Annual convention and exhibition at the Municipal Auditorium, Atlantic City, N. J., June 3-7.

National Electrical Manufacturers' Association.—Spring meeting at Hot Springs, Va., week of May 20.

Radio Manufacturers Association.—Annual trade show at the Stevens, Blackstone and Congress Hotels, Chicago, June 3-7.

Manufacturers' Catalogs

Beckwith Machine Company, Ravenna, Ohio. Leaflet describing apparatus for heating wax, cement, pitch, solder, enamel, resin, etc.

Winslow Boiler & Engineering Company, 844 Rush St., Chicago. "Kleen Heat," a common sense discussion of the advantages of oil burners, clearly set forth and beautifully illustrated.

Electric Valve Manufacturing Company, 68 Murray St., New York City. Bulletin 100, solenoid valves, packless type.

Partick & Wilkins Company, 51 N. 7th St., Philadelphia. Catalog 50, annunciators, electrical signalling devices and signalling systems.

Rochester Electric Products Corporation, 85-89 Allen St., Rochester, N. Y. Bulletin 94, the diverter pole generator for floating with bus control batteries.

Wagner Electric Corporation, St. Louis. Bulletin 162, Wagner transformer oil, discussing the purposes of transformer oil, its properties, methods of testing, precautions when handling and storing.

Wirt Company, Philadelphia. Catalog describing a number of the most common uses of resistance units. The specifications and applications for 47 units are presented together with comments regarding their usage.

Fibroc Insulation Company, Valparaiso, Ind. The Fibroc Manual; what Fibroc is, together with a description of its uses in both the electrical and mechanical industries and also suggestions for its fabrication by the most approved methods.

Information Wanted

We have been asked for the names and addresses of manufacturers of the articles listed herewith.

Replies from our readers to any of these inquiries will be greatly appreciated by the Information Bureau of Electrical Manufacturing, 461 Eighth Avenue, New York City.

"Burrows" Therapeutic Lamp.
"L. R. Co." Receptacles.
"Williams" Commutator Dressing.
"Splendida" Electric Iron.
"Graustark" Line of Lighting Fixtures.
"Sal Co. 176" Lamps.
"Electron" Heating Pad.
"Lilly Wilson" Vacuum Cleaner.
"Perkins" Siren.
"Flint" Waffle Iron.
"Packard" Vacuum Cleaner.
"Pioneer" House Pump.
"Blaisdell" Automatic Electric Cigar Lighter.
"Columbus-Universal" Electric Vacuum Cleaner and Floor Polisher.
"Defiance" Cigarette Lighter.
"Hillcrest" Line of Lighting Fixtures.
Manufacturers of Electric Incinerators.
Manufacturers of Electric-driven lampshade lacing machines.
"Vesodore" Cigar Lighter.

another achievement in simplified manufacturing

IN die casting the intricately designed cap for the oil strainer installed in domestic oil burner systems by Time-O-Stat Controls Co., the following results are achieved:—

A. The entire cap is delivered practically 100% ready for assembly.

B. 1/2″ pipe threads are cast in, in both the intake and outlet openings.

C. Engraved lettering is cast in.

D. Six tap holes for 3/16″ screws which hold the screen are accurately cast in.

E. Body-bolt hole is cast in.

F. Tapered seat for body-bolt head is cast in.

G. Face on under-flange is cast perfectly flat so that no further machining is required to seal the joint between the brass bowl and die cast cover.

By no other production method would it be possible to produce this part in one swift operation, at such low cost with practically all possible machining operations accomplished simultaneously as they are in the die casting process .. Perhaps parts of your product can be die cast with equally gratifying results.

Let us send you this illustrated, non-technical treatise on the die casting process. It may reveal new possibilities for simplified manufacturing of parts of your product.

An analysis of your product by Milwaukee Die Casting Engineers is yours for the asking. Why not write today?

MILWAUKEE DIE CASTING CO.
289 Fourth St. Milwaukee, Wis.

MILWAUKEE
DIE CASTINGS AND BEARINGS

New Goods for Your Inspection

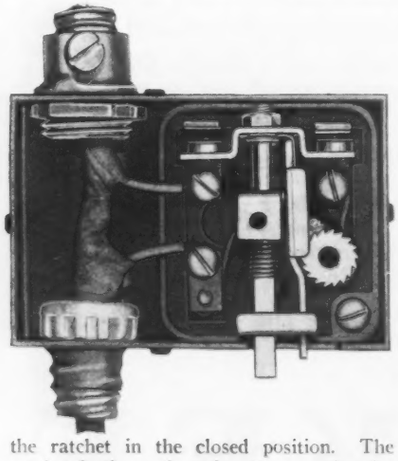
Refrigerator Starter

Diamond Elec'l Mfg. Co., 1318 E. 16th St., Los Angeles, Cal., offers in its KXR line of magnetic switches a combined manual and automatic across-the-line starting

switch particularly designed for refrigeration service. Featuring the KXR line of switches are panel and arc shields, thermal overload relay, low voltage release, small size, maximum wiring space, deep drawn steel box finished in black baked enamel, Bakelite starting lever set integral with panel, and remote control where desired.

Motor Starting Circuit Breaker

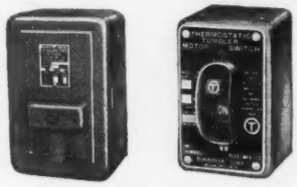
R. H. Maple Co., 3156 Ruckle, Indianapolis, Ind., is marketing the Maple self-soldering motor starting circuit breaker and switch. This switch is 2 in. wide, 2⅛ in. long and 1½ in. deep. It is composed of only seven stampings so that it is simple in construction. It is furnished in a range of sizes from one ampere capacity up to fifteen with any desired exact capacity between these limits. An overload current passing through the resistance element of the switch softens the solder which holds



the ratchet in the closed position. The ratchet is thus released and opens the circuit. The solder hardens quickly and on reclosing the breaker is ready to protect the motor against the next overload. It is designed to operate within 5 per cent of the setting desired. The resistance coil used determines the capacity of the circuit breaker and this cannot be altered by the operator. Thus over-fusing of the motor circuit is prevented.

Tumbler Type Motor Switches

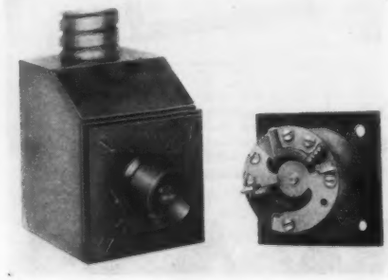
Trumbull Elec. Mfg. Co., Plainville, Conn., has brought out a line of tumbler type switches for use with electric motors from ¾ hp. to 2 hp. They are available in 2-pole and 3-way surface and flush types. These switches are for use on a variety



of small motor-driven machines and for automatic apparatus such as oil burners, ice machines, etc., and for lighting circuits. One type is used for motor control switch for maintaining liquid at a definite height in a tank or for special applications. Switches range in voltage from 125 volts to 600 volts, and in amperage from 3 to 30 amp.

Lincoln Safety Push Button

Lincoln Electric Co., Coit Rd. and Kirby Ave., Cleveland, Ohio, announces the Lincoln safety push button. The design of this button is a departure from the usual type of push button switch design in that a ball top "start" button is contained inside of a large "stop" button which projects over the "start" button. Thus the large projecting "stop" button protects the "start" button from accidental contact and the machine control can only be operated with the tip of a thumb or a finger inserted inside the "stop" button. The "start" button is of green molded Bakelite with the word "start" in white letters across the face and the surrounding "stop" button is of red molded Bakelite. The inner mechanism is inclosed in an arc welded steel box 2½ in. by 3¼ in. by 2½ in. All insulating parts are of molded Bakelite. By removing the four screws



holding the face plate to the container, the entire operating mechanism may be removed from the case for wiring. In the top of the steel case an opening ⅞ in. in diameter permits the entrance of conduit inclosed wire to the button.

Tenual Casting Metal

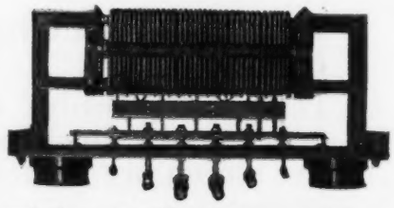
National Bronze & Aluminum Foundry Co., Cleveland, is marketing Tenual, a casting metal designed to overcome the usual wide variation in the physical properties of aluminum castings. This metal is manufactured by a process which eliminates the chance of aluminum oxide being contained in the metal by pouring the metal directly from the processing furnace into the castings. The manufacturer states that this metal has a much higher tensile strength and elastic limit and better elongation than is obtained with ordinary metals.

Phonograph Drive

Kendrick & Davis Co., Lebanon, N. H., has brought out the K. & D. Phonodrive, a simple electrically-driven phonograph motor. The frame of this motor is a special die casting and there are but two revolving shafts in the drive. The armature shaft is of ¼ in. tool steel and revolves in self-aligning bronze bearings. This shaft through its brass worm transmits power to a Bakelite worm gear on the vertical spindle to which the turntable is attached. An automatic switch works through a hole in the center of the vertical spindle. The motor is 7 in. long, 4 in. wide and 3 in. deep. It is equipped with a 110-volt Universal motor but other voltages up to 220 can be furnished on request.

Cast Grid Rheostat

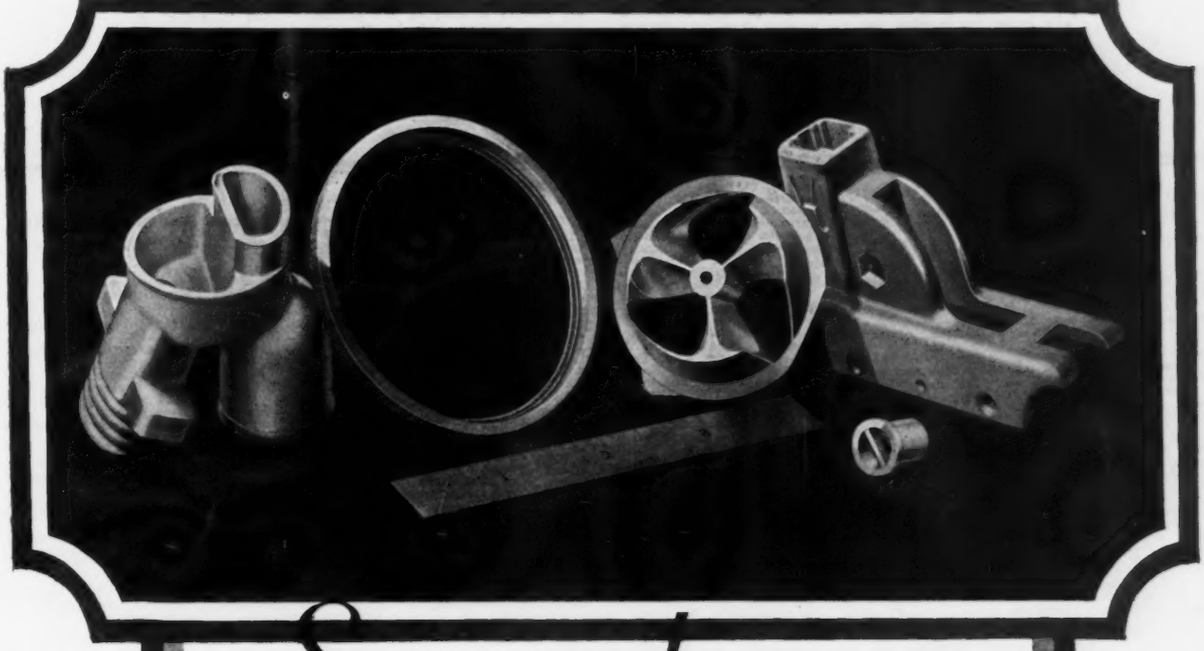
Columbia Electric Mfg. Co., 1292 E. 53rd St., Cleveland, announces the Columbia cast grid rheostat for the control of current passing through plating solutions. The cast grid resistor is said to reduce heating to a minimum, eliminate high resistance joints, breakage and loose connections at point of contact. These devices are of the parallel resistance type and afford both regulation of voltage and current, according to the generator voltage and the character of the plating. The panel is mounted on an angle framework



and the cast grid resistors mounted securely and bolted together in sections are fastened to the back of the panel. The grids are classified in sections and controlled by switches on the front of the board. The panel also contains a voltmeter, ammeter and rheostat for individual tank control. For controlling 6-volt circuits these rheostats are available in 9 sizes, from 400 to 3000 amp. capacity.

Dipping Lacquer Enamel

Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J., has placed on the market a black dipping lacquer enamel for use in insulating radio coils. It is designed to provide high dielectric strength, good covering and at the same time a minimum effect produced by high humidity.



Soundness

There is nothing more easy to claim, nor more difficult to maintain, than Quality. Yet Newton Quality is tangible, if the evidence of a maintained enthusiasm on the part of old customers carries weight. Continued preference with experienced buyers and the increasing number of new customers justifies our confidence in the soundness of our adherance to the standards of quality and service which have established the name Newton as having a definite meaning.

The NEWTON DIE CASTING Corp'n.

146 Munson St. NEWTON NEW HAVEN New Haven, Conn.

Index of Raw Materials, Parts, Electrical Equipment

For all electrical products including electrically operated machines and appliances

Trade Names—Manufacturers' Names—Local Addresses

The names of all manufacturers are grouped alphabetically under the heading for the product they manufacture. Trade names also appear in alphabetical position under the subject identifying the product. Thus "Linolac" insulating varnish will be found in alphabetical position under the heading "Paint, Varnish, Lacquer."

Note: The Classified Index of ELECTRICAL MANUFACTURING is limited to those subjects of interest to the specific field which it covers, for obvious reasons. A complete Classified Index of all electrical commodities bought, sold, or used by Electrical Supply Jobbers, Contractors, Dealers, Central Stations and other electrical industry outlets appears regularly in each issue of ELECTRICAL RECORD as heretofore. This Classified Index has been an exclusive ELECTRICAL RECORD feature for over thirty-six years.

ALLOYS, LIGHT METAL
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bohnalite. See Bohn Aluminum & Brass Corp.

ALUMINUM
(Also Aluminum Bronze Powder.)
Albron, Alcoa Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh.

AMMETERS. See Instruments.

ARMATURE
Balancers. See Balancers, Armature.
Banding Machines. See Banding Machines, Armature
Bearings. See Bearings.
Buggies. See Lifts, Armature.
Coil Presses. See Presses, Armature Coil.
Coils. See Coils, Finished.
Core Punchings. See Discs, Armature.
Cranes. See Lifts, Armature.
Discs. See Discs, Armature.
Driers. See Ovens.
Growlers. See Testers, Coil.
Hoists. See Lifts, Armature.
Impregnators, Vacuum. See Ovens, Industrial.
Jacks. See Lifts, Armature.
Laminations. See Discs, Armature.
Lathes. See Lathes.
Lifts. See Lifts, Armature.
New. See Coils, Finished.
Notching Machines. See Notching Machines, Armature.
Pegs. See Pegs, Armature.
Pinion Pullers. See Pullers, Armature Shaft.
Repaired. See Repairing and Second-Hand.
Shaft Pullers. See Pullers, Armature Shaft.
Shaft Straighteners. See Straighteners, Armature Shaft.
Stands. See Stands, Armature.
Test Benches. See Test Benches, Armature.
Testers. See Testers, Coil; also Test Benches, Armature.
Torpedo Cord. See Twine, Armature Winding.
Trouble Shooters. See Testers, Coil; also Test Benches, Armature.
Trucks. See Lifts, Armature.
Wedges. See Pegs, Armature.
Winding Machines. See Winding Machines, Armature & Field Coil.
Winding Twine. See Twine, Armature.

ARMATURE & COIL SPRAY GUNS. See Spraying Outfits.

ARMORING MACHINES. See Wire Manufacturing Machines.

ARMS, FLEXIBLE. See Tubing, Flexible Metallic.

ASBESTOS Shades. See Shades, Fabric.
Paper & Sheet. See Asbestos.
Slabs. See Asbestos Slabs.
Tape. See Tape, Asbestos.
Wire. See Wire, Insulated.
Yarn and Thread. See Yarn and Thread.

ASBESTOS
Sheet, Paper, Mill Board, Lumber.
Asbestos, Shingle, Slate & Sheathing Co., Ambler, Pa.
Easco. See Eastern Asbestos Co.
Eastern Asbestos Co., Providence, R. I.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
Johns-Manville Corp., New York, N. Y.

ASBESTOS SLABS
Slabs & Barriers for Switchboard.
Asbestos-Ebony. See Johns-Manville, Inc.
Decelco, Inc., Wayne, Mich.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
Johns-Manville Corp., New York, N. Y.
Transite. See Johns-Manville, Inc.
Zellite. See Decelco, Inc.

BAGS, Vacuum Cleaner
Merrimack Mfg. Co., Boston, Mass.

BALANCERS, Armature
(Dynamic Balancing Machines—Balancing Ways).
Anderson Bros. Mfg. Co., Rockford, Ill. (Ways).
Armature Coil Equip. Co., 2415 Forestdale Ave., Cleveland, O. (Machine).
Bowsher Co., N. P., South Bend, Ind.
Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. (Machines)
Sundstrand Machine Tool Co., Rockford, Ill.
Twentieth Century. See Sundstrand Machine Tool Co.
Vibration Specialty Co., 1534 Winter, Philadelphia, Pa. (Machines).

BALL BEARINGS. See Bearings, Ball and Roller.

BANDING MACHINES, Armature
Columbia Machine Wks. & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridion Company, Frank, Boston, Mass.

BARRIERS, Switchboard. See Slate; also Soapstone; also Asbestos.

BARS, BUS. See Brass, Bronze & Copper; also Aluminum.

BARS, Commutator
American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co.
Buckeye Tempered Copper & Brass Co., Mansfield, O.
Cameron Electric Mfg. Co., Ansonia, Conn.
Commutator Co., 131 N. Front, Minneapolis, Minn.
Electric Materials Co., North East, Pa.
Eureka Copper Products Corp., North East, Pa.
Homer Commutator Co., 4743 Hough Ave., N. E., Cleveland.
Rome Brass & Copper Co., Rome, N. Y.

BASES, Radio Tube. See Radio Molded Parts.

BASES, Reading Lamp
Metal, Pottery, Wood & Glass.

American Ring Co., Waterbury, Conn.
Aladdin Mfg. Co., Muncie, Ind.
Armor Bronze Co., Garwood, N. J.
Camden Art Tile & Pottery Co., Camden, Ark.
Colonial. See Old Colony Iron Wks.
Estes & Sons, E. B., 5844 Grand Central Terminal, New
Fulper Pottery Co., Flemington, N. J.
Globe Metal Spinning Co., 178 Centre, New York, N. Y.
Hemill Products, Inc., 103 Mett, New York, N. Y.
Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Marblseart. See Insulation Mfg. Co.
Natural. See Insulation Mfg. Co.
Old Colony Iron Wks., Bridgeport, Conn.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sneath Glass Co., Hartford City, Ind.
Van Briggle Tile & Pottery Co., Colorado Springs, Colo.
Weller, S. A., Zanesville, O. (Pottery.)
Yokel Corp., 219 Homestead Ave., Hartford, Conn.
Zane Pottery Co., South Zanesville, O.

BATTERY CHEMICALS. See Chemicals, Battery.
BATTERY CUT OUTS. See Switches, Battery.
BATTERY GAGES. See Instruments, Pocket.
BATTERY JARS. See Jars, Battery, Glass; also Rubber; also Molded Insulation.
BATTERY OXIDES. See Chemicals, Battery.
BATTERY SALTS. See Chemicals, Battery.
BEAD CHAIN. See Chain, Socket.
BEADS, Chandelier. See Crystals, Chandelier.

BEADS, Insulating
American Lava Corp., 1425 William, Chattanooga, Tenn.
Dunco. See Struthers Dunn, Inc.
Martindale Elec. Co., 1255 W. Fourth, Cleveland, O.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.

BEARINGS
Ball & Roller. See Bearings, Ball & Roller.
Graphite. See Bearings, Oil-less.
Oil-less. See Bearings, Oil-less.
Sleeve. See Bearings & Bushings.

BEARINGS, Ball and Roller
Ahlberg Bearing Co., 317 E. 29th, Chicago, Ill.
Bantam Ball Bearing Co., South Bend, Ind.
Commercial. See Schatz Mfg. Co.
C J B. See Ahlberg Bearing Co.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearing Co., Poughkeepsie, N. Y.
Gurney. See Marlin-Rockwell Corp.
Hyatt Roller Bearing Co., Newark, N. J.
Hoffman. See Norma-Hoffman Bearings Corp.
McGill Metal Co., Valparaiso, Ind.
Marlin-Rockwell Corp., Jamestown, N. Y.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
New Departure Mfg. Co., Bristol, Conn.
Nice Ball Bearing Co. (Nicetown), Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Whitehead Rd., Trenton,
Schatz Mfg. Co., Poughkeepsie, N. Y.
Schubert. See McGill Metal Co.
Standard Steel & Bearings, Inc., Plainville, Conn.
Strom Bearings Co., 4587 Palmer, Chicago, Ill.
S. K. F. Industries, 40 E. 34th, New York, N. Y.
Timken Roller Bearing Co., Canton, O.
Torrington Co., Torrington, Conn.

BEARINGS, Oil-Less
Argute Oilless Bearings Co., 149 Berkeley, Philadelphia, Pa.
B. M. C. See Burlington Metal Corp.
Bogert & Hopper, Inc., 225 Varick, New York, N. Y.
Bound Brook Oil-less Bearing Co., Bound Brook, N. J.
Burlington Metal Corp., Burlington, Wis.
Cleveland Graphite Bronze Co., 880 E. 72nd, Cleveland, O.
Electric Railway Equipment Co., 30 Church, New York, N. Y.
Elreco. See Electric Railway Equipment Co.
Graphalloy. See Graphite Metallizing Co.
Graphite Metallizing Co., Yonkers, N. Y.
Lubrite. See Merriam Bros., Yonkers, N. Y.
Merriam Bros., 185 Amory, Boston, Mass.
Metal Saw & Machine Co., Springfield, Mass.
Moraine Products Co., First & Foundry Sts., Dayton, O.
Neveroil Bearing Co., Wakefield, Mass.
Nolu Oilless Bearing Co., 6 E. Johnson, Philadelphia, Pa.
O. & S. Bearing Co., 315 S. Artillery, Detroit, Mich.
Reliance. See Metal Saw & Machine Co.
Seib Lignum-Vitae Woodturning Co., 98 Boyd Ave., Jersey City, N. J.
United States Graphite Bearing Co., Saginaw, Mich.

BEARINGS AND BUSHINGS
(For Armature Shafts.)
Adjustable Bearing Co., 101 Transportation Bldg., Indianapolis, Ind.
Ajax Metal Co., Philadelphia, Pa.
American Bronze Corp., Berwyn, Pa.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bunting Brass & Bronze Co., Toledo, Ohio.
Damascus Bronze Co., Pittsburgh, Pa.
Durex. See Moraine Products Co.
Federal-Mogul Corp., Shoemaker & Lillibridge Sts., Detroit,
Flood City Mfg. Co., Johnstown, Pa.
Johnson Bronze Co., New Castle, Pa.
Lumen Bearing Co., Buffalo, N. Y.
Moraine Products Co., First & Foundry Sts., Dayton, O.
National Bearing Metal Corp. (More-Jones Brass & Metal Div.), 4930 Manchester Ave., St. Louis, Mo.
United States Graphite Co., Saginaw, Mich.

BELTING, Chain Transmission. See Chain, Power Transmission.

BELTS, Rubber
Molded Cord Rubber Belts for Electrical Appliances.
Fay Rubber Products Co., Elyria, O.
Gilmer Co., L. H. (Tacony), Philadelphia, Pa.

BENDERS, Coil Loop
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Segur. See Electric Service Supplies Co.

BENDING. See Punching & Bending.
BINDING POSTS. See Posts, Binding.

BLADES, Fan
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y
Torrington Mfg. Co., Torrington, Conn.

BLUESTONE. See Chemicals, Battery.
BOARD, Fuller. See Cloth and Paper.
BOARD, Press. See Cloth and Paper.
BOWL HOLDERS. See Fixture Fittings.
BOX & CABINET BUSHINGS. See Bushings, Box & Cabinet.

BOX BOARD
Container Corp. of America, 111 W. Washington, Chicago.
Mid-West Box Co., 111 W. Washington, Chicago.

BOXES, Fibre
Container Corp. of America, 111 W. Washington, Chicago.
Corrfibre. See Container Corp. of America.
Mid-West Box Co., 111 W. Washington, Chicago.

BOXES, Sheet Steel. See Cabinets, Sheet Steel.
BOXES, Wood. See Cabinets & Boxes, Wood.

BOXES AND WRAPPERS
Brown & Bailey Co., 417 N. Eighth, Philadelphia, Pa.
Bulldog. See Pittsburgh Corrugated Paper Box Co.
Campbell Paper Box Co., South Bend, Ind.
Consolidated Paper Co., Monroe, Mich.
Container Corp. of America, 111 W. Washington, Chicago.
Gair Co., Robert, 420 Lexington Ave., New York. (Boxes.)
Gator-Hide Kraft. See International Paper Co.
Hinde & Dauch Paper Co., 325 Decatur, Sandusky, Ohio.
Huntington Paper Box Co., Huntington, Ind.
International Paper Co., 100 E. 42nd, New York, N. Y.
Lake Lithographing Co., 2570 Superior Ave., Cleveland, O (Display Cartons.)
Mid-West Box Co., 111 W. Washington, Dept. 36, Chicago
National Folding Box Co., New Haven, Conn. (Cartons.)
Pequot Mfg. Corp., Glendale (L. I.), New York.
Pittsburgh Corrugated Paper Box Co., Pittsburgh, Pa.
River Raisin Paper Co., Monroe, Mich.
Rockford Fibre Container Co., Rockford, Ill.
Sefton Mfg. Co., 59 E. Madison, Chicago, Ill.
Shuttleworth Carton Co., 474 W. Broadway, New York.

BRACKETS, Instrument
For Suspending Meters to Station Switchboard.
General Electric Co., Schenectady, N. Y.
Roller-Smith Co., 289 Broadway, New York, N. Y.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

BRAIDING MACHINES. See Wire Manufacturing Machines.

BRASS TUBING. See Tubing, Brass and Copper

BRASS, BRONZE AND COPPER
Sheet, Rod, Bar.
American Brass Co., 25 Broadway, New York, N. Y.
American Nickeloid Co., Peru, Ind.
Anaconda. See American Brass Co.
Baltimore Brass Co., 1212 Wicomico, Baltimore, Md.
Baltimore Copper Mills, (Div. of General Cable Corp.) Baltimore, Md.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bohnalite. See Bohn Aluminum & Brass Corp.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn
Buffalo Bronze Die Cast Corp., 100 Arthur, Buffalo, N. Y.
Dallas Brass & Copper Co., 829 Orleans, Chicago, Ill.
Durbar. See Buffalo Bronze Die Cast Corp.
Electric Materials Co., North East, Pa.
Federal-Mogul Corp., Shoemaker & Lillibridge Sts., Detroit,
Nickeloid. See American Nickeloid Co.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
Titan Metal Mfg. Co., Bellefonte, Pa. (Rods and Forgings.)

BREAKERS, Circuit. See Circuit Breakers.
BRIDGES, Wheatstone. See Instruments, Laboratory Standard.
BRONZE. See Brass, Bronze and Copper; also Castings.
BRONZE, Phosphor. See Phosphor Bronze.
BRONZE POWDER, Aluminum. See Aluminum.
BRUSH HOLDERS. See Brushes, Commutator.
BRUSHES, Carbon. See Brushes, Commutator.
Graphite. See Brushes, Commutator.
Metal Graphite. See Brushes, Commutator.

BRUSHES, COMMUTATOR
(Brushes, Brush Holders and Flexible Leads.)

Brush Holders	See H
Carbon, Graphite, Metal Graphite	See C
Flexible Leads and Pig Tails	See L
Sheet Metal	See S
Wire Gauze	See W

Automotive Mfg. Co., Kansas City, Mo.						H
B. B. B. See Becker Bros. Elec'l Corp.						
Baylis Co., Bloomfield, N. J.						H
Becker Bros. Elec. Corp., 23 N. Jefferson, Chicago, Ill.	C	W	S	H	L	
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y.	C					
Boxill-Bruel Carbon Co., Columbia Park, O.	C					H
Calebaugh Self-Lubricating Carbon Co., 1503 Columbia Ave., Philadelphia, Pa.	C					

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This Alumac Al Die Casting, is used in the Sturtevant Vacuum Cleaner, combines Nozzle, Fan Housing and Regulator. Note deep undercut of fan housing.

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Advance Tool & Die Casting Co.
1654-60 Holton St., Milwaukee, Wis.
Edgewood 284

BRUSHES, Commutator—Continued
Carbon Engrg. Co., Slinger, Wis. C L
Carbon Laboratories Co., 5005 Euclid Ave., Cleveland, O. C
Carbon & Graphite Corp., 227 West Broadway, New York, N. Y. C
Carenco. See Carbon Engineering Co.
Chapin Co., Chas. E., 227 Fulton St., New York, N. Y. C W S L
Columbia Machine Wks. & M. L. Co., 263 Chestnut, Brooklyn, N. Y. H
Cooley Mfg. Co., 98 Park Place, New York W
Diamond C. See Chapin Co., Chas. E.
Dixon Crucible Co., Joseph, Jersey City
Electra. See Automotive Mfg. Co.
Electric Accessories Co., 310 York Ave., Philadelphia, Pa. H
Electro-Nite Carbon Co., 308 N. Fourth, Philadelphia, Pa.
Eureka Copper Products Corp., North East, Pa. W S H
Fleck Carbon Co., 508 Broome, New York C H
General Electric Co., Schenectady, N. Y. C H
Graphalloy. See Graphite Metallizing Corp.
Graphite Metallizing Corp., 1040 Nepperhan Ave., Yonkers, N. Y. C H
Henrite Products Co., 98 Park Place, New York, N. Y. C
Holland Trolley Supply Co., 1623 E. 43rd, Cleveland, Ohio H
Jeandron, W. J., 345 Madison Ave., New York, N. Y. (Imported.) C
Keystone Carbon Co., 4630 N. 11th, Philadelphia, Pa. C
Kohlenite Products Co., 417 W. 28th, New York, N. Y. C
Le Carbone. See Jeandron, W. J.
Le Valley Vitae Carbon Brush Co., 4851 Grand Central Terminal, New York, N. Y. C
Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich. C
Morganite Brush Co., 33-02 48th Ave., Long Island City, N. Y. C
National Carbon Co., Cleveland, O. C
New Process Carbon Co., 1503 Columbia Ave., Philadelphia, Pa. C L
No Spark. See Calebaugh Self-Lubricating.
Ohio Carbon Co., 8215 Almira Ave., Cleveland, Ohio C W L
Ohio Elec. Specialty Mfg. Co., Troy, O. W
Perfection Supply Co., 98 Park Pl., New York, N. Y. C W S H L
Pittsburgh Carbon Brush Co., 127 Fancourt, Pittsburgh, Pa. C
Pure Carbon Co., Wellsville, N. Y. C W S L
Pyramid. See National Carbon Co.
Reaction. See Baylis Co.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y. W L
Salem Electrical Supply Co., Salem, Mass. W
Seabury, Ralph L., Factories Bldg., Toledo, O. C
Smarr & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. C
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y. C L
Speer Carbon Co., St. Mary's, Pa. C
Stackpole Carbon Co., St. Mary's, Pa. C
Sterling. See Carbon Laboratories Co.
Superior Carbon Products Co., North Rd., Poughkeepsie, N. Y. C
U. S. Graphite Co., Saginaw, Mich. C
Universal. See Graphite Metallizing Corp.
Weber Elec. Wks., Brooklyn Sta., Cleveland. C L
BRUSHES, PNEUMATIC SPRAYING. See Spraying Outfits.

BRUSHES FOR VACUUM CLEANERS

Omaha Brush Co., 320 N. 15th, Omaha, Neb. (Brushes rebristled.)
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.
BUGGIES, Armature. See Lifts, Armature.

BULBS, Glass

For Incandescent Lamps and Tubes.
Almo Mfg. Co., 38 Crawford, Newark, N. J.
Corning Glass Wks., Corning, N. Y.
Fayette Glass Bulb Co., 229 21st, Brooklyn, N. Y.
Libby Glass Co., Toledo, O.
BUNCHING MACHINES. See Wire Manufacturing Machines.
BUSHINGS, SHAFT. See Bearings and Bushings.

BUSHINGS, Box and Cabinet, Porcelain

Appleton Electric Co., 1704 Wellington Ave., Chicago, Ill.
Columbia Metal Box Co., 226 E. 144th St., New York, N. Y.
Harter. See Multi Elect. Mfg. Co.
Knox Porcelain Corp., Knoxville, Tenn.
Mineralite Electric Co., 25 N. Peoria, Chicago, Ill.
Multi Electric Mfg. Co., 210 N. Ogden Ave., Chicago, Ill
Nelson Elec. Co., Plant City, Fla.
CABINET GRILL CLOTH. See Cloth, Untreated.

CABINETS, Fibre

Continental-Diamond Fibre Co., Bridgeport, Pa.
Vulcawood. See Continental-Diamond Fibre Co.
CABINETS, Refrigerator. See Refrigerator Cabinets

CABINETS, Sheet Steel

Stamped and Turned-up Boxes and Cabinets.
Acme Blow Pipe & Sheet Metal Wks., New Orleans, La
Adam Electric Co., Frank, St. Louis, Mo.
All-Steel-Equip. Co., Aurora, Ill.
American Metal Wks., 4868 Stanton Ave., Philadelphia, Pa
American Steel Furniture Co., 27 W. 24th, New York, N. Y.
Aurora Steel Products Co., Aurora, Ill.
Benjamin Elec. Co., 1378 E. 16th, Los Angeles, Cal.
Berks Engineering Co., Reading, Pa.
Berthold Elec. Co., Gus, 555 W Monroe, Chicago, Ill.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y

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C. & P. Electric Wks., Springfield, Mass.
Cleveland Switchboard Co., 2925 E. 79th, Cleveland, O.
Coast Specialty Co., 72 E. Sixth, Portland, Ore.
Cole Metal Products Co., 33 Crescent, Long Island City.
Columbia Elec. Mfg. Co., 59 Columbus Sq., San Francisco, Cal.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Columbian Steel Tank Co., 1505 W. 12th, Kansas City, Mo.
Commercial Mfg. & Supply Co., 1443 Delaware St., Denver.
Diamond Elec'l Mfg. Co., 1330 E. 16th, Los Angeles, Cal.
Dowman-Dozier Mfg. Co., 1314 Murphy Ave., S. W., Atlanta, Ga.
Electric Panelboard Co., 426 Exchange, Rochester, N. Y.
Electric Apparatus Co., 702 N. Halsted, Chicago, Ill.
Federal Steel Products Co., 2 Ave. L, Newark, N. J. (Polarized Boxes.)
Fouch Elec. Mfg. Co., 105 N. Ninth, Portland, Ore.
Greater New York Metal Box Co., Inc., 143 W. 19th, New York.
Green Elec. Co., 31 N. Water, Rochester, N. Y.
Gurney Sheet Metal Wks., 718 E. 4th, Long Beach, Cal.
Hauer, J. B., Driggs Ave. and N. 11th, Brooklyn, N. Y.
Holzer Sheet Metal Wks., Inc., New Orleans, La.
Hough Mfg. Co., 2520 24th, Detroit, Mich.
Isert Co., J. H., 1234 Rowan, Louisville, Ky.
Karp Metal Products Co., 129 30th, Brooklyn, N. Y.
Kirtland Elec. Construction Co., 34 Herkimer, Albany, N. Y.
Large-Dail Mfg. Co., 406 Cherry St., Philadelphia.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lexington Elec. Products Co., 419 E. 24th, New York, N. Y.
Lorentzen, H. K., 155 Leonard, New York, N. Y.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Manafield Elec. Hardware Co., Longview Ave., Manafield, O.
Metropolitan Elec. Co., 2914 First Ave., S., Seattle, Wash.
Metropolitan Elec. Products Co., Blvd. at 14th, Long Island City, N. Y.
Milwaukee Vault & Cabinet Co., 521 Market, Milwaukee.
Mosher, S. L., 1951 Lawrence, Denver, Colo.
National Metal Box Co., Van Dyke & Ferris Sts., Brooklyn.
Newman Elec. & Mfg. Co., Eau Claire, Wis.
Parr Metal Products Corp., 3519 41st, Long Island City, N. Y.
Penn Electrical Co., 35 Water, Irwin, Pa.
Powerlite Switchboard Co., 4149 E. 79th, Cleveland, O.
Rezioh. See Holzer Sheet Metal Works.
Robbins & Myers, Inc., Springfield, O.
Security. See Aurora Steel Products Co.
Standard Metal Box Corp., 950 Grand St., Brooklyn, N. Y.
Star Metal Box Co., 238 46th, Brooklyn, N. Y.
Superior Switchboard & Devices Co., 420 Schroyer Ave., Canton, O.
Tanner & Co., Wm. F., 511 S. Sharp, Baltimore, Md.
United Metal Box Co., 473 President, Brooklyn, N. Y.
United Sheet Metal Wks., 575 Howard, San Francisco.
Universal Metal Box & Products Co., 316 Colt, Irvington N. J.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Wardack Elec. Mfg. Co., 4444 Clayton Ave., St. Louis, Mo.

CABINETS AND BOXES, Wood

Ampere. See Donehue Lumber Co.
Aston Cabinet Mfrs., 1223 W. Lake, Chicago, Ill.
Boehm Cabinet Co., J., 2216 W. 83rd St., Cleveland, O.
Buckeye Mfg. Co., Springfield, O.
Carolina Wood Products Co., Asheville, N. C.
Carrom Co., Ludington, Mich.
Caswell-Runyon Co., Huntington, Ind.
Cheney Piano Action Co., A. C., Castleton, N. Y.
Clinton Corp., 342 Madison Ave., New York, N. Y.
Corlieth Cabinet Mfg. Co., St. Mary's, Pa.
Cory Cabinet Corp., Springfield, Mo.
Denker Co., Geo. Henderson, Ky.
Donehue Lumber Co., Smith and State, Perth Amboy, N. J.
Ebert Furniture Co., 225 W. 34th, New York, N. Y
Eflein & Sons, Frederick, 44 Central Ave., Brooklyn, N. Y.
Empire-United Hat Block Co., 312 E. 22nd, New York.
Estes & Sons, E. B., 5344 Grand Central Terminal Bldg., New York, N. Y.
Excello Products Corp., 4838 W. 16th, Cicero, Ill.
Findlay Mfg. Co., Metropolitan & Morgan Aves., Brooklyn, Grand Rapids Furniture Co., Grand Rapids, Mich.
Harper Mfg. Co., Cassopolis, Mich.
Hickory Box Co., Hickory, N. C.
Hubbell, H. L., 59 Market Ave., N. W., Grand Rapids.
Interstate Woodworking Co., 46 Wooster, New York, N. Y.
Karpen. See Studner Bros.
King Mfg. Corp., Rano & Crowley, Buffalo, N. Y.
Klumpp Sons, John G., 13 Baxter, New York, N. Y.
National Cabinet Co., New Philadelphia, O.
New England Box Co., Greenfield, Mass.
Oneida Cabinet Corp., Oneida, N. Y.
Ottawa Furniture Co., Holland, Mich.
Pooley Co., 16th & Indiana Ave., Philadelphia, Pa.
Radio Allied Mfrs Corp., 1340 S. Michigan Ave., Chicago.
Radio Cabinet Mfg. Corp., Furniture Mart, Chicago, Ill.

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156 East Buffalo St., Milwaukee, Wis.

Radio Cabinet & Equipment Co., 1504 Vine, Philadelphia.
Radio Mfg. Co., Div. of Pillied Lumber Co., Swanton, O.
Radio Master Corp., Bay City, Mich.
Red Lion Cabinet Co., Red Lion, Pa.
R. E. Z. Cabinet Co., 54 North, Boston, Mass.
Rockford Sales Corp., 206 Lexington Ave., New York, N. Y.
Schutz Bros., 152 Chambers, New York, N. Y.
Signal Elec. Mfg. Co., Menominee, Mich.
Southern Toy Co., Hickory, N. C.
Specialty Display Case Co., Kendallville, Ind.
Starr Piano Co., Richmond, Ind.
Stradivara Co., Coshocton, Ohio.
Stettner Phonograph Corp., 318 E. 75th, New York.
Studner Bros., 67 W. 44th, New York, N. Y.
Superior Cabinet Corp., 206 Broadway, New York, N. Y.
Syracuse Screen & Grille Co., North Manchester, Ind.
Tessier Bros., 355 Bridge, Northampton, Mass. (Radio.)
Trenton Wood Specialty Co., Stokes Ave. and P. R. R., Trenton, N. J.
Udell Wks., 28th and Barnes Ave., Indianapolis, Ind.
West Box Co., 235 Liberty, Springfield, Mass
Wood Cabinet Corp., 196 Lexington Ave., New York, N. Y.
CABLE ARMORING MACHINES. See Wire Manufacturing Machines
CABLE TEST SETS. See Instruments, Portable and Switchboard.
CABLING MACHINES. See Wire Manufacturing Machines.

CANDLES, Fixture

Glass, Fibre Paper.
Brandywine Fibre Products Co., 1402 Walnut, Wilmington.
Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Fibre Products Co., New Bedford, Mass.
Franklin Fibre Specialty Co., 173 Lafayette, New York, N.Y.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Seamless. See Fibre Products Co.

CANOPY (Canopies). See Fixture Fittings.
Insulators. See Insulators.
Switches. See Switches, Snap.
CAPACITORS, RADIO. See Radio Circuit Components.

CARBON, Powdered

Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich.
CARBONS, Battery. See Carbons.
Arc Light. See Carbons.

CARBONS

Battery Arc Light.
Becker Bros. Elect. Corp., 23 N. Jefferson, Chicago, Ill.
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y.
Columbia. See National Carbon Co.
Daylight. See National Carbon Co.
Lessing Battery. See Blanck & Carrier Corp.
Nuernberg Battery. See Blanck & Carrier Corp.
National Carbon Co., Cleveland, Ohio.
Oretip. See National Carbon Co.
Silvertip. See National Carbon Co.
Speer Carbon Co., St. Mary's, Pa.
Stackpole Carbon Co., St. Mary's, Pa.
CARTONS. See Boxes and Wrappers.
CASEIN PLASTICS. See Molded Insulation.
CASES, Eliminator. See Cases, Eliminator.
Flashlight. See Cases, Flashlight.

CASES, Eliminator

Brumberger Co., 252 Pearl, New York, N. Y.
Grand Sheet Metal Wks., 176 Grand, New York, N. Y.
Karp Metal Products Co., 129 30th, Brooklyn.
Luna Tin Mfg. Co., 547 W. 21st, New York, N. Y.

CASES, Flashlight

Bridgeport Brass Co., 744 E. Main, Bridgeport, Conn.
Lincoln Fibre Specialty Co., Newport, Del.
St. Louis Paper Can & Tube Co., St. Louis, Mo.
Underwood Battery Co., 1250 Ontario, Cleveland, O.
CASTINGS, Aluminum. See Castings, Aluminum. Also
Castings, Copper, etc.
Brass. See Castings.
Bronze. See Castings.
Copper. See Castings.
Die. See Castings, Die.
Monel Metal. See Castings.
Steel. See Castings, Steel.
White Metal. See Castings.

CASTINGS, Aluminum

Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
Berks Foundry & Mfg. Co., West Hamberg, Pa.
Bohm Aluminum & Brass Corp., Detroit, Mich.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Dick Bros., Inc., Reading, Pa.
Eureka Copper Products Corp., North East, Pa.
Monarch Aluminum Ware Co., 9301 Detroit Ave., Cleveland,
National Bronze & Aluminum Foundry Co., 88th & Lazy, Cleveland O.
Quality Aluminum Casting Co., Waukesha, Wis.
Tenual. See National Bronze & Aluminum Foundry Co.
Veco Mfg. Co., South Norwalk, Conn.

CASTINGS

Copper, Brass, Bronze, Monel Metal, White Metal.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Berks Foundry & Mfg. Co., West Hamberg, Pa.
Bohn Aluminum & Brass Corp., Detroit.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Bridgeport Castings Co., 250 North Ave., Bridgeport, Conn.
Central Pattern & Foundry Co., 3737 S. Sacramento Ave., Chicago, Ill.
Chase Brass & Copper Co., Waterbury, Conn.
Dick Bros., Inc., Reading, Pa.
Eureka Copper Products Corp., North East, Pa.
Parlin Mfg. Co., Decatur, Ill.
Federal-Mogul Corp., Shoemaker & Lillibridge Sts., Detroit.
Harsch, John, Bronze & Foundry Co., 11612 Madison Ave., Cleveland, O.
McGill Metal Co., Valparaiso, Ind.
National Bronze & Aluminum Foundry Co., 88th & Lazy, Cleveland, O.
Ohio Pattern Wks. & Fdy. Co., 2730 Spring Grove Ave., Cincinnati, O.
Rahn Bronze Foundry, 617 West Belgrave, Huntington Park, Cal.
Sterling Art Metal Wks., 40 Purvis, Long Island City, N. Y.
Tenual. See National Bronze & Aluminum Foundry Co.

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CASTINGS, Die
Advance Tool & Die Casting Co., 1654 Holton, Milwaukee, Wis.
Alemite Die-Casting & Mfg. Co., 2640 Belmont Ave., Chicago, Ill.
Allied Die-Casting Corp., Long Island City, N. Y.
Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
Aluminum Industries, Inc., 2838 Beekman, Cincinnati, O.
American Die Casting Co., 2040 Dominick, Chicago, Ill.
Badger Die Casting Co., 158 East Buffalo, Milwaukee, Wis.
Barnhardt Bros. & Spindler, Monroe & Throop St., Chicago.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Do-Di. See Doehler Die Casting Co.
Doehler Die Casting Co., 386 Fourth Ave., New York, N. Y.
Federal-Mogul Corp., Shoemaker & Lillibridge Sts., Detroit.
Franklin Die Casting Corp., 826 Gifford, Syracuse, N. Y.
Illinois Die Castings Co., 503 S. Jefferson, Chicago, Ill.
Krone-Seebek Die Casting & Mfg. Co., 2935 W. 47th, Chicago, Ill.
Milwaukee Die Casting Co., 291 Fourth, Milwaukee, Wis.
Newton Die Casting Corp., 146 Munson, New Haven, Conn.
Paragon Die Casting Co., 3221 Ravenswood Ave., Chicago, Ill.
Perfection Die Casting Corp., 406 Lakeside Ave., N. W., Cleveland, O.
Permite. See Aluminum Industries, Inc.
Soss Mfg. Co., Roselle, N. J.
Stewart Die Casting Co., 4500 Fullerton Ave., Chicago, Ill.
Superior Die Casting Co., 875 E. 70th, Cleveland, Ohio.
Twin City Die Castings Co., Talmadge and 33rd Aves., S. E., Minneapolis, Minn. (White Metal).

CASTINGS, Gray Iron
American Engineering Co., Philadelphia, Pa.
Athens Foundry Co., Athens, Pa.
Barlow Foundry Co., 551 N. J. R. R. Ave., Newark, N. J.
Barnett Foundry Co., Newark, N. J.
Berks Foundry & Mfg. Co., West Hamberg, Pa.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Bridgeport Castings Co., 250 North Ave., Bridgeport, Conn.
Dick Bros., Inc., Reading, Pa.
Fairmount Foundry, Inc., Third & Westmoreland Sts., Philadelphia, Pa.
Forest City-Walworth Run Fuondries Co., 2500 W. 27th, Cleveland, O.
Gray Iron Foundry Co., Reading, Pa.
Milwaukee Grey Iron Foundry Co., 3910 Mitchell, Milwaukee, Wis.
North Wales Mach. Foundry Co., North Wales, Pa.
Products Machine Co., Bridgeport, Conn.
Sacks Iron Foundry, L., 357 Wilson Ave., Newark, N. J.
Snead & Co., Pine St., Jersey City, N. J.
St. Louis Malleable Castings Co., 7701 N. Conduit Ave., St. Louis, Mo.
Union Mfg. Co., New Britain, Conn.
Western Foundry Co., Kedzie Ave. at 36th, Chicago, Ill.

CASTINGS, Steel
Bonney-Floyd Co., Columbus, Ohio.
Eastern Steel Casting Co., Ave. L & Edward St., Newark
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Riverside Steel Casting Co., Jacobus Ave., Kearney, N. J.

CEMENT, Commutator
Anchorlute. See Technical Products Co.
Armstrong. See Electric Power Maintenance Co.
Conductalute. See Technical Products Co.
Early, Edward E., 1129 W. Fifth, N. W., Canton, O.
Electric Power Maintenance Co., 21 N. Third, Minneapolis
Fixlwick. See Technical Products Co.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Imperial. See Martindale Electric Co.
Martindale Electric Co., 1255 W. Fourth, Cleveland, O.
Mitchell Rand Mfg. Co., 19 Vesey, New York, N. Y.
Perce-Lute. See Perfection Supply Co.
Perfection Supply Co., 98 Park Pl., New York, N. Y.
Plas Mica Co., 26 St. Andrews Place, Yonkers, N. Y.
Technical Products Co., 116 S. Sheridan Sq., Pittsburgh, Pa
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

CEMENT, Liquid Porcelain
Anchorlute. See Technical Products Co.
Fire Lute. See Technical Products Co.
Insa-Lute. See Technical Products Co.
Okonite Co., Passaic, N. J.
Repairet Mfg. Co., Milwaukee, Wis.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa
Thermoid. See Technical Products Co.

CHAIN, Chandelier (Fancy). See Crystals, Chandeliers

CHAIN DRIVES. See Chain, Power Transmission.

CHAIN, Fixture
Acco. See American Chain Co.
American Chain Co., Bridgeport, Conn.
Chase Brass & Copper Co.
Eastern Chain Works, 309 E. 22nd St., New York, N. Y.
Faries Mfg. Co., Decatur, Ill.
Globe Metal Mfg. Co., 2122 E. Hazard, Philadelphia, Pa
H. & O. Chain Co., So. Norwalk, Conn.
Newark Metal Mfg. Co., 22 S. 6th, Newark, N. J.
Plume & Atwood Mfg. Co., Waterbury, Conn.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Steele & Johnson Mfg. Co., Waterbury, Conn.
Universal Metal Chain Co., 75 Clymer, Brooklyn, N. Y.

CHAIN, Power Transmission
Baldwin Chain & Mfg. Co., Worcester, Mass.
Boston Gear Wks. Sales Co., Norfolk Downs, Mass
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Link-Belt Company, 910 S. Michigan Ave., Chicago, Ill
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Inc., Albany, N. Y.
Reeves Pulley Co., Columbus, Ind.
Renold Boston. See Boston Gear Wks.
Union Chain & Mfg. Co., Sandusky, O.
Whitney Mfg. Co., Hartford, Conn.

CHAIN, Socket
American Ball Chain Works, 12 Wooster St., New York
Bead Chain Mfg. Co., Bridgeport, Conn.
H. & O. Chain Co., South Norwalk, Conn.

CHANDELIER BEADS. See Crystals, Chandelier.

CHANDELIER CRYSTALS. See Crystals, Chandelier

CHANDELIER FRINGE. See Crystals, Chandelier

CHARGERS, Magnet
Charging, Remagnetizing.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Cowie Elec. Co., E. S., 1823 Wyandotte, Kansas City, Mo
Fore Elec. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo
Serwell Sales Corp., 1749 N. Winchester Ave., Chicago
Valley Electric Co., 4221 Forest Park Blvd., St. Louis, Mo.

CHEMICALS, Battery
Electrolyte, Battery Salts, Battery Oxides, Sal Ammoniac Bluestone, Manganese.
Cooper & Co., Charles, 194 Werth, New York, N. Y.
Eagle-Picher Lead Co., 134 N. LaSalle, Chicago. (Oxide.)
Elmer & Amend, 205 3rd Ave., New York, N. Y.
Electro Chemical Co., 113 W. Court St., Dayton, O.
General Metallic Oxides Co., Jersey City, N. J.
Globe Chemical Co., Murray Rd. and Big Four R. R., Cincinnati, O.
Grasselli Chemical Co., Guardian Bldg., Cleveland, O
Kalbfleisch Corp., 200 5th Ave., New York, N. Y.
Klipstein Co., 644 Greenwich, New York, N. Y.
Merrimac Chemical Co., 148 State, Boston, Mass.

SUNDH Control
for
AC and DC

Elevator Control
Fire Pump Control
Pressure Regulators
Float Switches
Automatic Starters
Manual Starters
Speed Regulators
Machine Tool Control
Magnet Operated Switches
Valves, Magnet Operated
Transfer Switches

SUNDH
TRADE MARK

Sundh Electric Co., Inc.
Newark, N. J.

Powers-Weightman-Rosengarten Co., Philadelphia, Pa.
Voltah. See Powers-Weightman-Rosengarten Co.
Wah Chang Trading Corp., 233 Broadway, New York, N. Y.

CHEMICALS, Refrigeration
Ansul Chemical Co., Marinette, Wis.
Arctic. See Roessler & Hassiacher Chemical Co.
Carbide & Carbon Chemicals Corp., 30 E. 42nd, New York, N. Y. (Butane & Isobutane.)
Dry Ice Corp. of America, 50 E. 42nd, New York, N. Y.
Roessler & Hassiacher Chemical Co., 709 Sixth Ave., New York, N. Y. (Methyl Chloride, Ethyl Chloride.)
Virginia Smelting Co., West Norfolk, Va. (Sulphur Dioxide.)
Chromium Plating. See Plating & Finishing.

CHUCKS, Magnetic
J & H Elec. Co., 161 Clifford, Providence, R. I.
Simmons. See Taft-Pierce Mfg. Co.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S (Rockdale), Worcester, Mass.

CIRCUIT BREAKERS
Air and Oil Circuit Breakers and Oil Break Switches.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Anderson Mfg Co., Albert & J. M., 289 A, Boston, Mass.
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Automatic Switch Co., 617 E. Larned, Detroit, Mich.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Condit Elec'l Mfg. Corp., 838 Summer St. (South Boston), Boston, Mass.
Crambiett Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
General Electric Co., Section W-234, Merchandise Dept. Bridgeport, Conn.
Hart & Hegeman Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
High Tension Elecl. Specialty Co., 500 Washington, Abington, Mass.
Hitesco. See High Tension Elecl. Specialty Co.
H. & H. See Hart & Hegeman Div.
Inducto-therm. See Allen-Bradley Co.
I. T. E. Circuit Breaker Co., 19th and Hamilton Sts. Philadelphia, Pa.
Line Material Co., South Milwaukee, Wis. (Oil Switches.)
Maple Co., R. H., Indianapolis, Ind.
Martindale Elec. Co., 1255 W. Fourth, Cleveland, O.
Minibraker. See Burke Controller Co.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Sentinel. See Westinghouse Elec. & Mfg. Co.
Takamine Corp., 208 Rawson, Long Island City, N. Y.
Trumbull-Vanderpool Elec. Mfg. Co., Bantam.
U-Re-Lite. See I. T. E. Circuit Breaker Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

CIRCUIT TESTERS. See Testers, Fuse and Circuit

CLEANER BAGS, Vacuum. See Bags, Vacuum Cleaner.

CLEANER BRUSHES, Vacuum. See Brushes for Vacuum Cleaners.

CLEANERS, Metal
Jakite Products, Inc., 26 Thames, New York, N. Y.

CLIPS, Fuse. See Fuse Clips.

CLIPS, Heater Plug
Gray Bros. Co., Plano, Ill.

CLOCK SWITCHES. See Switches, Time.

CLOTH GEARS. See Gears and Pinions, Composition.

CLOTH LOUD SPEAKER DIAPHRAGM. See Cloth, Untreated

CLOTH RADIO GRILL. See Cloth, Untreated.

CLOTH, Untreated
Boyle & Co., John, 112 Duane, New York, N. Y.
Canvas, "Aeroplane Cloth," Cotton Duck, Drill. Diaphragm Cloth, Grill Fabrics, etc
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pindall Fabrics Corp., 200 Madison Ave., New York, N. Y. (Grill Cloth)

CLOTH AND PAPER, Insulating
Cloth, Insulated ..... See C
Paper, Insulated ..... See P
Fibre Paper (Fish Paper) ..... See F
Press Board (Fuller Board) ..... See B
Silk ..... See S

Acme Wire Co., New Haven, Conn ..... C S P . . .
Armco. See Rogers Paper Mfg. Co.
Armatite. See Mica Insulator Co.
Brand & Co., William, 268 4th Ave., New York ..... P . . .
Campbellite. See National Vulcanized Fibre Co.
Carbolold Products Corp., 15 Park Row, New York, N. Y. ..... C . . P . . .
Case Brothers, Inc., Highland, Park, Conn. . . . . P . . B
Case Mfg. Co., Unionville, Conn. ..... P . . .
Case & Risley Press Paper Co., Oneco, Conn. . . . . P . . .
Celoron Co., Bridgeport, Pa. ..... P F B
C-F. See National Vulcanized Fibre Co.
Chicago Mica Co., 345 Campbell, Valparaiso, Ind. ..... C . . . . .
Continental-Diamond Fibre Co., Bridgeport, Pa. ..... P . . .
De Jonge & Co., Louis, 69 Duane, New York, N. Y. (Condenser) ..... P . . .
Dexstar. See Dexter & Sons.
Dexter & Sons, C. H., Windsor Locks, Conn. (Condenser Tissue.)
Dielectric Mfg. Co., St. Louis, Mo. ..... C S P . . B
Electrite. See West Virginia Pulp & Paper Co.
Fiberoid. See Wilmington Fibre Specialty Co.
General Electric Co., Section I-483, Merchandise Dept., Bridgeport, Conn. ..... C . . P . . .
Hartford City Paper Co., Hartford City, Ind. (Glassine Condenser Tissue).
Hewitt & Bros., C. B., 16 Ferry, New York C . . P . . .
Hi-Tex. See Stevens Paper Mills.
Incella. See Tarentum Paper Mills Co.
Irvington Varnish & Insulator Co., Irvington, N. J. ..... C S P . . .
Manning Paper Co., J. A., Troy, N. Y. ..... R
Mica Insulator Co., 200 Varick, New York C S P . . B

Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y. ..... P . . .
National Vulcanized Fibre Co., Wilmington, Del. ..... F . .
New Jersey Wood Finishing Co., Woodbridge, N. J. ..... C . . . . .
Ohmoid. See Wilmington Fibre Specialty Co.
Old Hick. See Hewitt & Bros., C. B.
Peerless. See National Vulcanized Fibre Co.
Rogers Fibre Co., 210 Lincoln, Boston, Mass. . . . . F . .
Rogers Paper Mfg. Co., South Manchester, Conn. ..... B
Schweitzer, Inc., Peter J., 200 Fifth Ave., New York, N. Y. (Condenser Tissue.)
Seutan Co., 342 Madison Ave., New York . . . . P . . .
Sico. See Standard Insulation Co.
Standard Insulation Co., East Rutherford, N. J. ..... C S P . . .
Sterling Fireboard Co., 501 Fifth Ave., New York. (Varised Hard Fibreboard) ..... B
Sterlite. See Sterling Firebrand Co.
Stevens Paper Mills, Windsor, Conn. ..... B
Tarentum Paper Mills Co., Tarentum, Pa. ..... P . . .
Turbonite. See Brand & Co., Wm.
Union Mills Paper Mfg. Co., New Hope, Pa. . . . P . . .
Warren Mfg. Co., 342 Madison Ave., New York, N. Y. ..... P . . .
West Virginia Pulp & Paper Co., 230 Park Ave., New York ..... B
Wilmington Fibre Specialty Co., Wilmington, Del. ..... P . . .

CLUTCHES, Magnetic
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.

COIL (Coils).
Armature and Field. See Coils, Finished.
Choke (Power). See Fittings, High Tension.
Choke (Radio). See Radio Circuit Components.
Driers & Impregnators. See Ovens.
Electromagnet. See Coils, Finished.
Flatteners. See Rolls, Coil Flattening.
High Frequency. See Electro-Therapeutic; also Radio Circuit Components; also Ignition Outfits.
Impregnators, Vacuum. See Ovens, Industrial.
Induction. See Coils, Finished; also Electro-Therapeutic.
Loop Benders. See Benders, Coil Loop.
Medical. See Electro-Therapeutic.
Presses. See Presses, Armature Coil.
Radio. See Radio Circuit Components.
Removers. See Removers, Coil.
Resistance. See Units, Rods & Grids; also Radio Circuit Components.
Shaping Machines. See Shaping Machines, Coil.
Spark. See Ignition Outfits.
Spreaders. See Winding Machines, Armature & Field Coil.
Tamping Tools. See Tools, Coil Tamping.
Taping Machines. See Taping Machines, Coil.
Tools. See Ignition Outfits.
Testers. See Testers, Coil; also Test Benches, Armature.
Winders, Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Winders, Induction Coil. See Winding Machines, Industrial Coil.
Winding Forms. See Forms, Coil Winding.
Windings (Magneto). See Coils, Finished.
Wire Tension Devices. See Tension Devices, Coil Wire.

COILS, Finished
Armature, Field, Electromagnet and Induction Coils.
Acme Products Co., Boston, Mass.
Acme Wire Co., New Haven, Conn.
Aero-Call. See Aero Products, Inc.
Aero Products, Inc., 1772 Wilson Ave., Chicago, Ill.
Auth Electrical Specialty Co., 422 E. 53rd St., New York.
A. & A. See Electrical Coil Winding Co.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Bunnell & Co., J. H., 32 Park Place, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Cameron Elec. Mfg. Co., Ansonia, Conn.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.
Easton Coil Co., Easton, Pa.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland, O.
Electrical Coil Winding Co., 27th & Sanderson Sts., Camden, N. J.
Electrical Products Mfg. Co., Providence, R. I.
Fredericks Co., H. M., Lock Haven, Pa.
Globe Technolian Corp., Reading, Mass.
Herald Electric Co., 29 East End Ave., New York, N. Y.
Marion Elec. Mfg. Co., 34 Cliff, Jersey City, N. J.
Modern Elec Mfg. Co., 312 Mulberry, Toledo, Ohio.
National Elec. Corp., 226 High, Newark, N. J.
Pifer Elec. Repair & Mfg. Co., 3610 Superior Ave., Cleveland, O.
Polymet Mfg. Co., 599 Broadway, New York, N. Y.
Robertson-Davis Co., 361 W. Superior, Chicago, Ill.
Robertson, Leo F., 536 West 22nd St., New York, N. Y.
Rome Wire Co. (Div. of General Cable Corp.), Rome, N. Y.
Sevisur Magneto Engrg. Co., 397 Phillips, Toledo, O.
Stunz & Barron, 210 E. Pratt, Baltimore, Md.
Toledo Standard Commutator Co., 2242 Smead Ave., Toledo, O.
Universal Winding Co., Boston, Mass.
Varley Duplex Magnet Co., 15 Exchange Place, Jersey City, N. J. (Electromagnetic only).
Whittler & Ditmer Inc., 1611 Beacon, Brookline, Mass

COMMUTATOR
Bars. See Bars, Commutator.
Cement. See Cement, Commutator.
Dressers. See Stones, Commutator.
Lubricants. See Compounds, Commutator.
New. See Commutators.
Refilled. See Repairing and Second Hand.
Slotters. See Slotting Machines & Tools, Commutator
Slotting Files. See Files, Commutator Slotting.
Soldering Machines. See Soldering Machines, Commutator
Stones. See Stones, Commutator.
Tighteners. See Tighteners, Commutator.
Truing Devices. See Tools, Commutator Truing.

COMMUTATORS
Derby Commutator Co., Derby, Conn.
Electric Materials Co., North East, Pa.
Eureka Copper Products Corp., North East, Pa.
Homer Commutator Co., Cleveland, Ohio.

COMMUTATOR BRUSHES. See Brushes, Commutator.

COMPOSITION PULLEYS. See Pulleys, Composition.

COMPOUNDS, Sealing. See Wax and Compounds.

CONDENSER UNITS, Refrigerator
Bush Mfg. Co., Hartford, Conn.
McCord Radiator & Mfg. Co., Richelle & E. Grand Ave., Detroit, Mich.
Rome-Turney Radiator Co., Rome, N. Y.

CONDENSERS, Radio. See Radio Circuit Components.

CONDENSER TUBING. See Tubing, Brass and Copper.

CONNECTORS, Pin-Plug
Kliegl Bros. Universal Electric Stage Ltg. Co., 321 W. 50th, New York, N. Y.

CONNECTORS, Wire
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill. (Solderless-Tapeless).

CONTACT POINTS. See Points, Contact.

CONTAINERS, Shipping. See Fibre Board Products.

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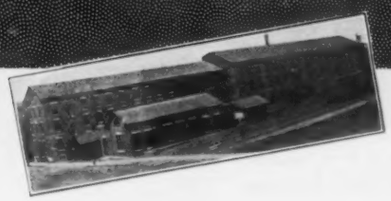

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CONTROLLERS, Motor

Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Anderson & Co., C. J., 212 W. Austin, Chicago, Ill.
Automatic Switch Co., 154 Grand, New York, N. Y.
Betts, Inc., James H., 1393 Sedgwick Ave., New York N. Y. (Traffic.)
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
B-G Oil Burner Co., Stockton, Cal.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Condit Elec'l Mfg. Corp., 838 Summer St. (South Boston), Boston, Mass.
Cutler-Hammer Mfg. Co., 1238 St. Paul Ave., Milwaukee.
Diamond Elecl. Mfg. Co., 1330 N. 16th, Los Angeles, Cal.
Dinkey. See Elec. Controller & Mfg. Co.
E C & M Youngstown. See Electric Controller & Mfg. Co.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.
Electrite. See Sundh Elec. Co.
General Electric Co., Schenectady, N. Y.
Horni Signal Mfg. Corp., 515 Greenwich, New York.
Industrial Controller Div. of Square D Co., S. Pierce & Hanover, Milwaukee, Wis.
Maimin Speed Control Corp., 251 W. 19th, New York. (Sewing Machines.)
Monitor Controller Co., 51 Gay, Baltimore, Md.
National Electric Controller Co., 5315 Ravenswood Ave., Chicago, Ill.
Refrigerating Specialties Co., 728 S. Sacramento Blvd., Chicago, Ill.
Resisto. See Allen-Bradley Co.
Rowan Controller Co., 306 N. Holliday, Baltimore, Md
Square D Co., 6060 Rivard, Detroit, Mich.
Sundh Elec. Co., Parkhurst St. at Ave. C, Newark, N. J
Switcholone. See Condit Elec. Mfg. Co.
Thermaload. See Monitor Controller Co.
Trumbull Electric Mfg. Co., Plainville, Conn.
Uemco. See Union Elec. Mfg. Co.
Unelco. See Union Elec. Mfg. Co.
Union Elec. Mfg. Co., Milwaukee, Wis.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
W. K. See Westinghouse Elec. & Mfg. Co.

COPPER. See Brass, Bronze and Copper; also Castings
COPPER TUBING. See Tubing, Brass and Copper
CORD TIPS. See Tips, Cord.

CORES, RESISTANCE COIL (Lava)

American Lava Corp., 1425 William, Chattanooga, Tenn.
Crescent. See M. Kirchberger & Co.
Es-El-Co. See Southern Lava Co.
Kirchberger & Co., M., 1425 37th, Brooklyn, N. Y.
Lavite. See Steward Mfg. Co.
Lavarock. See M. Kirchberger & Co.
Southern Lava Co., Rossville, Ga.
Steward Mfg. Co., D. M., Chattanooga, Tenn.
Tennessee Burner Mfg. Co., Chattanooga, Tenn.
XL. See Tennessee Burner Mfg. Co.

CORES, RESISTANCE COIL (Refractory Porcelain)

American Lava Corp., 1425 William, Chattanooga, Tenn.
Colonial Insulator Co., Akron, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O
Elemite. See Louthan Mfg. Co.
Fireite. See Hartford Faience Co.
Hartford Faience Co., Hartford, Conn.
Louthan Mfg. Co., E. Liverpool, O.
Thermal Syndicate, 58 Schenectady Ave., Brooklyn, N. Y.
Vitrecoil. See Thermal Syndicate.
Woolley, Inc., W. Douglas, East Liverpool, O.

COTTON DUCK. See Cloth, Untreated.
COTTON SLEEVING. See Tape, Cotton.
COUNTERS, Revolution. See Tachometers.

COUPLINGS, Shaft (Flexible-Insulated)

Bartlett Hayward Co., Baltimore, Md.
Bond Co., Charles, 617 Arch, Philadelphia, Pa.
Delbee Rubber Co., Syracuse, N. Y.
Falk Corp., Milwaukee, Wis.
Franke. See Smith & Serrell.
General Electric Co., Schenectady, N. Y.
Grundy. See Bond Co.
Krone-Seebek Die Casting & Mfg. Co., 2935 W. 47th, Chicago, Ill.
Lipe, W. C., Syracuse, N. Y.
Lovejoy Tool Wks., 319 W. Ohio, Chicago, Ill
Mather. See Bond Co.
Nuttall Wks., of Westinghouse Elec. & Mfg. Co., McCandless Ave. & Harrison St., Pittsburgh, Pa.
Oneida. See Delbee Rubber Co.
Smith & Serrell, 24 Washington Pl., Newark N. J
Webster Mfg. Co., 1856 N. Kostner Ave., Chicago, Ill.
Wood's Sons Co., T. B., Chambersburg, Pa

COVERING MACHINES, WIRE. See Wire Manufacturing Machines.

CUPS, Grease

Bowen Products Corp., Auburn, New York
Gits Bros. Mfg. Co., 1960 S. Kilbourn Ave., Chicago, Ill.
Lunkenheimer Co., Cincinnati, Ohio.

CUPS, Oil

Gits Bros. Mfg. Co., 1960 S. Kilbourn Ave., Chicago, Ill.

CUT OUTS, Battery. See Switches, Battery.
CUTTING OUTFITS, Metal. See Welding and Cutting Outfits.
CRANES, Floor. See Lifts, Armature.

CRYSTALS, Chandelier

Crystals, Prisms, Beads, Chains, Fringes.
Crystal Venezia. See Harrison & Co., Arthur.
Friedlaender Co., 49 W. 23rd, New York, N. Y.
Harrison & Co., Arthur, 561 W. Washington Blvd., Chicago
Hirschberg, Shutz & Co., 268 4th Ave., New York, N. Y
(Fringes.)
Nelson Bead Co., 15 W. 37th, New York, N. Y. (Importer.)
Rialto Import Co., 112 W. 4th, New York, N. Y.
Schwartz Lighting Fixture Wks., 1341 Noble, Philadelphia

Wyle & Bros., J. J., 20 E. 27th, New York, N. Y.

CURRENT INDICATORS. See Instruments, Packet.
DASHBOARD METERS. See Instruments, Portable and Switchboard.

DECALCOMANIA

Meyercord Co., 120 S. La Salle, Chicago, Ill.
Novar. See Palm Fechteler & Co.
Palm Fechteler & Co., 67 5th Ave., New York, N. Y.

DIALS

Radio (Metal). See Radio Fittings.
Radio (Molded). See Radio Molded Parts.
Enameled. See Dials, Enameled.

DIALS, Enameled

Wolfe Co., Horace R., Pequabuck, Conn.

DIAPHRAGM, Cloth. See Cloth, Untreated.
DIE CASTINGS. See Castings, Die.
DIE MAKERS. See Dies, Die Makers.

DIE SETS

Baumbach Mfg. Co., 1810 Kilbourn Ave., Chicago, Ill.
Daily Machine Specialties, Inc., 2104 S. 52nd Ave., Chicago, Ill.

DIES, Pipe. See Stocks, Dies and Reamers.

DIES, DIE MAKERS

Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Mareck & Nebel, 255 Greenwich, New York, N. Y.

DISCS, Armature

Steel Discs, Laminations, and Segments for Motors and Transformers.
American Stamping Co., 978 E. 64th, Cleveland, O.
Cleveland Armature Works, 4732 St. Clair Ave., Cleveland
Hercules Elec. Steel Corp., 145 Lafayette, New York, N. Y
Lamination Stamping Co., 764 Windsor, Hartford, Conn.

DRAWING MACHINES, WIRE. See Wire Drawing Machines.
DRIVE SCREWS. See Screws, Drive.
DRIVES, CHAIN. See Chain, Power Transmission.

DYNAMOMETERS

Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Diehl Mfg. Co., Elizabeth, N. J.
General Electric Co. Schenectady,

EBONITE. See Rubber, Hard.
ELECTROLYTE. See Chemicals, Battery.
ELECTROMAGNETS. See Coils, Finished.

ELECTRODES FOR GAS SIGNS

American Neon Light & Sign Corp., 625 Sixth Ave., New York, N. Y.
Eisler Engineering Co., 756 S. 13th, Newark, N. J.
Manhattan Elecl. Supply Co., 190 Sixth Ave., New York,

ELECTRODYNAMOMETERS. See Instruments, Laboratory Standard.
ELEMENTS, Heating. See Units, Rods and Grids.

ENAMELING MACHINES (For Magnet Wire)

(See Also Wire Manufacturing Machines).
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.

ENGRAVING MACHINES

Portable Bench and Pedestal Outfits for Marking Metal.
Brewster Co., Wm., 30 Church, New York, N. Y.
Deckel. See Preis & Co., Inc., H. P.
Engravograph Corp., 12 Vestry, New York, N. Y.
Etchograph. See Brewster Co., Wm.
Gilbert Supply Co., Independence, Iowa.
Gorton Machine Co., Geo., Racine, Wis.
Preis & Co., Inc., H. P. Newark, N. J.

ENGRAVING, Radio Panel

Engraving to Order.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa
Eisler Engineering Co., 756 S. 13th, Newark, N. J.
(Tube Base Branders).
Etch-O-Gravure. See Insuline Corp. of America.
General Fabricating Co., 165 Greenwich, New York, N. Y.
Globe Mfg. Co., 101 Spokane St., Seattle, Wash.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
New England Products Co., 232 Greenwich, New York.
Preis & Co., Inc., H. P., 227 Fulton, New York, N. Y.
Schwenke Machine Engraving Co., 2036 Woodward Ave., Detroit, Mich.
Varichrome Laboratories, 4614 Spring Grove Ave., Cincinnati,
Wright Radio Co., 114 Exchange, Rockland, Mass.

EYELETS

Platt Bros. & Co., Waterbury, Conn.
Waterbury Brass Goods Co., Waterbury, Conn.
Waterbury Button Co., 835 S. Main, Waterbury, Conn.

FABRIC, Radio Grill. See Cloth, Untreated.
FABRIC SHADES. See Shades, Fabric.
FAN BLADES. See Blades, Fan.

FEET, Felt

Brawley, T. R., 279 20th, Brooklyn, N. Y.

FELT

Advance Felt & Cutting Co., 609 W. Lake, Chicago.
American Felt Co., 211 Congress, Boston, Mass.
Booth Felt Co., 460 18th, Brooklyn, N. Y.
Brawley, T. R., 279 20th, Brooklyn, N. Y.
Western Felt Wks., 4029 Ogden Ave., Chicago, Ill.

FERRULES

Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, 490 Hancock Ave., Bridgeport, Conn.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Massachusetts Machine Shop, Inc., Boston, Mass.
Patton-MacGuyer Co., Providence, R. I.
Platt Bros. & Co., Waterbury, Conn.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., 99 Mill, Waterbury, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., Waterbury, Conn.

FIBRE BOARD PRODUCTS (Solid and Corrugated)

Container Corp. of America, 111 W. Washington, Dept. 36, Chicago, Ill.
Mid-West Box Co., 111 W. Washington, Chicago.
Sefton Mfg. Corp., 59 E. Madison, Chicago, Ill.

FIBER CANDLES. See Candles, Fixture.
FIBRE GEARS. See Gears and Pinions, Composition.
Paper. See Cloth and Paper.
Radio Panels. See Radio Molded Parts.
Shipping Containers. See Fibre Board Products.
Vulcanized. See Fibre, Vulcanized.

FIBRE, Phenol

Moisture Proof: Sheet, Rod, Tubes.
Armite. See Spaulding Fibre Co.
Bakelite-Dilecto. See Continental Fibre Co.
Campbell Fibre Co., Heather Ave., Stanton, Del.
Campbellite. See Campbell Fibre Co
Celoron Co., Div. of Continental-Diamond Fibre Co., Bridgeport, Pa.

FIBRE—*cut to any form*
Sheet, Rod, Tubing
MICA
VARNISHED CLOTH
COTTON TAPES AND SLEEVING
Everything for the Motor
Send for New Insulation Catalogue
THE CONSUMERS RUBBER CO
CLEVELAND 1302-4-6 ONTARIO ST
CHICAGO 320 WRIGLEY BLDG.

Continental-Diamond Fibre Co., Bridgeport, Pa.
Fibroc Insulation Co., 245 Lincoln Ave., Valparaiso, Ind.
Formica Insulation Co., 4638 Spring Grove Ave., Cincinnati, O.
Franklin Fibre Specialty Co., Wilmington, Del.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Phenolite. See National Vulcanized Fibre Co.
Spaulding Fibre Co., Tonawanda, N. Y.
Synthane Corp., Oaks, Pa.
Vul-Cot. See National Vulcanized Fibre Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

FIBRE, Vulcanized

Sheet, Rod, Tube, Horn, Fibre, Bushings, Washers, Cleats, Screw Machine Products.
Brandywine Fibre Products Co., 1402 Walnut St., Wilmington, Del.
Conite. See Continental-Diamond Fibre Co.
Continental-Diamond Fibre Co., Bridgeport, Pa.
Delaware Hard Fibre Co., Wilmington, Del.
Diamond F. See Continental-Diamond Fibre Co.
Egyptian. See Delaware Hard Fibre Co.
Electrosote. See Pantasote Co.
Fibre Products Co., New Bedford, Mass.
Franklin Fibre Specialty Co., Wilmington, Del.
Fyberoid. See Wilmington Fibre Specialty Co.
Independent Laboratories, 50 E. 42nd, New York, N. Y.
Iten Fibre Co., 5403 Bower Ave., Cleveland, O.
Leatheroid. See Rogers Fibre Co.
Lincoln Fibre & Specialty Co., Newport, Del.
National Vulcanized Fibre Co., Wilmington, Del.
Ohmoid. See Wilmington Fibre Specialty Co.
Pantasote Co., Inc., 250 Park Ave., New York, N. Y.
Peerless. See National Vulcanized Fibre Co.
Rogers Fibre Co., 210 Lincoln, Boston, Mass.
Spaulding Fibre Co., Tonawanda, N. Y.
Standard Fibre Products Co., 36 Pleasant, Watertown, Mass.
Vul-Cot. See National Vulcanized Fibre Co.
Vulcawood. See Continental-Diamond Fibre Co.
Wilmington Fibre Specialty Co., Wilmington, Del.

FIBRE WASHERS. See Fibre.
FIELD COILS. See Coils, Finished.

FILAMENTS, Incandescent Lamp

Conneway Elec. Laboratories, 406 Jefferson St., Hoboken.
Filament Supply Co., 1317 Willow Ave., Hoboken, N. J.
Gilby Wire Co., Riverside Ave., Newark, N. J.
Kauter & Nuetzi, 3709½ Lisbon Ave., Milwaukee, Wis.
Vacuum Tube Products, Staneck Trust Bldg., Hoboken, N. J.
Volkmar & Sons, 187 Sylvan Ave., Newark, N. J. (Lead-in-Welds.)

FILES, Commutator Slotting

Ideal Commutator Dresser Co., 1008 Park, Sycamore, Ill.
Martindale Electric Co., 1255 W. Fourth, Cleveland, O.

FISH PAPER. See Cloth and Paper.
FITTINGS, Fixture. See Fixture Fittings.
FIXTURE CANDLES. See Candles, Fixture.
FIXTURE CHAIN. See Chain, Fixture.
FIXTURE, Collars. See Fixture Fittings.

FIXTURE FITTINGS

	KEY
Bowl Holders	See B
Brass Fittings	See B
Canopies	See B
Collars	See B
Crow Feet	See I
Finials (Brass, Glass and Porcelain)	See B
Hangers	See H
Hickies, Brass	See B
Hickies, Iron	See I
Hooks, Brass	See B
Hooks, Iron	See I
Iron Fittings	See I
Loops, Brass	See B
Loops, Iron	See I
Rings	See B
Shade Holders	See S
Shells	See B
Spinnings	See B
Stampings	See B
Stems	See B
Straps	See H
Studs	See I

Acme Lighting Products, Inc., 2114 Woodland Ave., Cleveland, O. Straps . . . . . H
American Chain Co., Bridgeport, Conn. (Loops and Rings.) . . . . . B . . . . .
American Ring Co., Waterbury, Conn. (Candle.) . . . . B . .
Appleton Electric Co., 1703 Wellington Ave., Chicago, Ill. . . . . B I . . .
Arco. See American Ring Co.
Arrow Electric Division of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. . . . . S . .
Artoloid. See Great Eastern Brass Wks., Inc.
Art Metal Co., 3721 Dayton, Cleveland, O. . . . . H
Banlite. See East Side Metal Spinning Co.
Banner. See Plume & Atwood Mfg. Co.
Barton Brass Wks., 3627 Superior, Detroit. . B . . . . .
Belmet. See B. & L. Metal Stamping Co.
Bloch Bros., 88 Walker, New York. . . . . B . . . . .
Brandt Mfg. Co., 3727 Gratiot Ave., Detroit. B . . . . .
Braun, J. G., 609 S. Pauline, Chicago, Ill. (Pressed Ornaments.) . . . . . B I . . . .
B. & L. Metal Stamping Co., 250 Moore, Brooklyn, N. Y. (Also Combination Wall Bracket Hanger.) . . . . . B I . . H
Cambridge Brass Co., Cambridge, Mass. . . . . B . . . . .
Chase Brass & Copper Co., Waterbury, Conn. B . . S . .
Cleanexy. See Dunlap Co.
Colonial Stamping Co., Brill St. & Passaic Ave., Newark, N. J. . . . . B . . S . .
Crescent Brass Mfg. Co., Reading, Pa. . . . . B . . . . .
Crouse-Hinds, Solvay Sta., Syracuse, N. Y. . . . . S H
Diamond Needle & Mfg. Co., Torrington, Conn. (Hickies.) . . . . . I . . .

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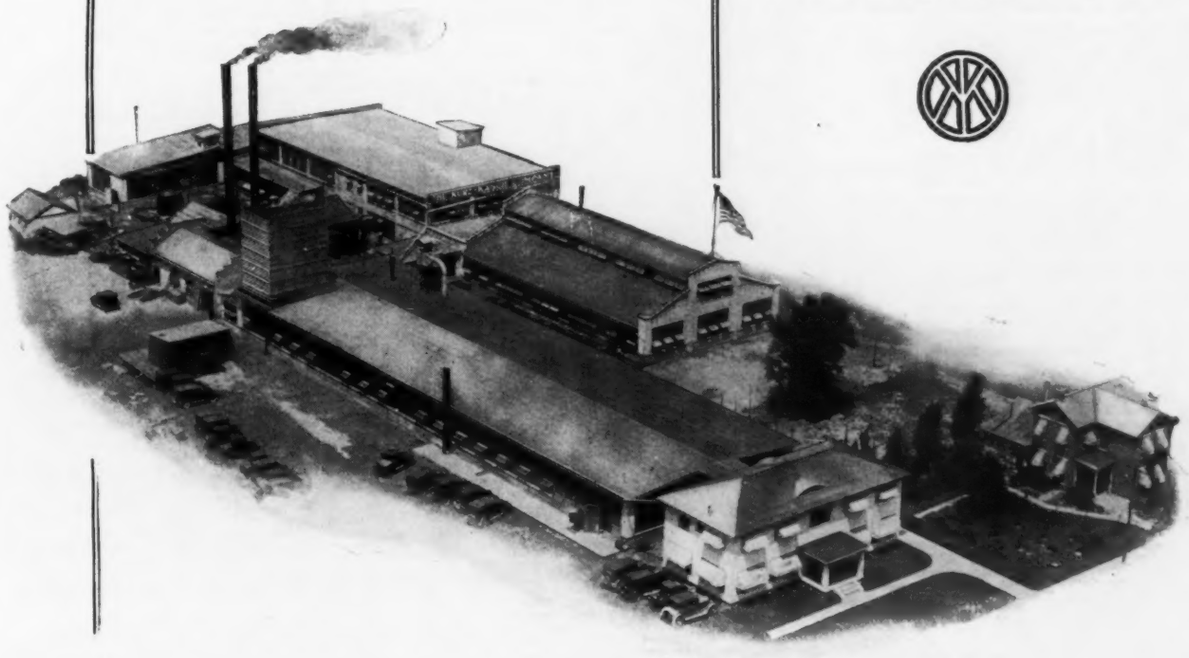


FIXTURE FITTINGS—Continued
Duniap Co., John, Carnegie, Pa. B
East Side Metal Spinning Co., 451 Greenwich, New York, N. Y. B
Eureka Tin Ware Mfg. Co., 135 W. 20th, New York, N. Y. S
E-Z Up. See Plume & Atwood Mfg. Co.
Faries Mfg. Co., Decatur, Ill. B I S H
Flaherty Co., M. E., 28 S. Clinton, Chicago. I
Fralick Co., S. R., 15 S. Clinton, Chicago. I
Franklin Brass Foundry Co., Reading, Pa. B
Friedley-Voshardt Co., Chicago, B
Grabler Mfg. Co., 6565 Broadway, S. E., Cleveland, O. I
Great Eastern Brass Wks., Inc., 182 Grand, New York, N. Y. (Spindles).
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. S
Incandescent Supply Co., 468 West Broadway, New York, N. Y. B H
Isco. See Incandescent Supply Co.
Jiffy. See White Mfg. Co., J. H.
Kwikon. See Fralick Co., S. R.
Lakin. See Thomas & Betts Co.
Liberty Brass Turning Co., 88 Walker, New York, N. Y. I
Liberty Iron Pipe & Nipple Works, 62 Greene, New York, N. Y. B I
Liberty Machine Co., Wauwatosa, Wis. B I
Light Metal Stamping Co., 310 13th St., West New York, N. J. S
L & K Mfg. Co., 440 Adelphi, Brooklyn, N. Y. H
L. & W. Brass Wks., 361 W. Superior, Chicago, Ill. B
Madelite. See Belson Mfg. Co.
M. S. W. Mfg. Co., 1527 Niagara Ave., Buffalo, N. Y. I
Metal Products Co., 210 Canal, New York. B
Metro Iron Ornament Co., 191 Christie, New York, N. Y. I
Metropolitan-Columbia Mfg. Co., 714 Metropolitan Ave., Brooklyn, N. Y. B
Midwest Elec. Co., 1639 Walnut, Chicago, Ill. I
Mid-West Chandelier Co., 14th & Chestnut Sts., Kansas City, Mo. B
Michell-Vance Co., 70 Washington, Brooklyn, N. Y. S
Monarch. See Perfecilite Co.
Murlin Mfg. Co., Philadelphia, Pa. B I
National Electric Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa. (Studs.) I
New Era Elec. Mfg. Co., 6725 Machinery Ave., N. E., Cleveland, O. H
New Wrinkle. See Bryant Elec. Co.
New York Brass Turning Co., 568 Broadway, New York, N. Y. B
Noblit. See Fralick & Co., S. R.
N. W. Cleat Receptacle Bracket, 2437 N. 29th, Philadelphia, Pa. I
Onli. See Perfecilite Co.
Pass & Seymour, Solvay Sta., Syracuse, N. Y. B S
Perfecilite Co., 1457 E. 40th, Cleveland. S
Pittsburgh Valve & Fittings Co., Barberton, O. I
Plume & Atwood Mfg. Co., Waterbury, Conn. B S H
Plumwood. See Plume & Atwood Mfg. Co.
Plymouth. See Vester Sons, Alfred.
Products Machine Co., Bridgeport, Conn. B
Reading Brass Co., 141 Schiller, Reading, Pa. B I
Ribaysem Mfg. Co., J., 952 W. Lake, Chicago, Ill. B
Rodale Mfg. Co. 200 Hudson, New York. B H
Sandow Tool Co., 1440 Bway, New York, N. Y. S
Scovill Mfg. Co., Waterbury, Conn. B I
Simpalite. See Sprecher Mfg. Co., P. W.
Simplex. See Plume & Atwood Mfg. Co.
Springfast. See Plume & Atwood Mfg. Co.
Square-G. See Grabler Mfg. Co.
Standard Snap-Lite Corp., 504 Jackson Ave., Long Island City, N. Y. S
Standard Metal Spinning Co., 128 Mott, New York, N. Y. B
Star. See Perfecilite Co.
Star. See Steel City Elec. Co.
Steel City Elec. Co., Pittsburgh, Pa. I
Steele & Johnson Mfg. Co., Waterbury, Conn. B S
Stembridge, Tenny & Brandt, 29 S. Clinton, Chicago, Ill. (White Metal). B
Sterling Spinning & Stamping Wks., 476 Broome, New York, N. Y.
T. & B. See Thomas & Betts Co.
Thomas & Betts Co., 63 Vesey, New York. I
Uno. See Bryant Elec. Co., also Crouse-Hinds, also General Elec. Co., also Hart & Hegeman Mfg. Co., also Pass & Seymour.
United. See L & K Mfg. Co.
United Metal Spinning Co., 440 Adelphi, Brooklyn, N. Y. B
Vester, Sons, Alfred, 5 Mason, Providence, R. I. B
Victor. See Plume & Atwood Mfg. Co.
Virden, Div. of Gill-Virden Co., 6108 Longfellow Ave., Cleveland, O. B
Walden Tool & Metal Mfg. Co., New Haven Conn.
Wameco. See Waterbury Metal Wares Co.
Waterbury Co., Waterbury, Conn. B
Waterbury Metal Wares Co., Waterbury, Conn. S
Weber Brass Co., Whitney Power Block, Cleveland, O B
White Diamond. See White Mfg. Co., J. H.
White Mfg. Co., J. H., 111 N. 3rd, Brooklyn, N. Y. B S
Wilhite Machine Wks., 1245 S. Hope, Los Angeles, Cal. B

FLASHERS, Sign

Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.

Ajax. See Reynolds Spring Co.
A. & W. See General Outdoor Adv. Co.
Angelus. See Electric Sign Flasher Corp.
Betts, Inc., James H., 1393 Sedgwick Ave., New York. (Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.)
Betts & Betts Corp., 645 W. 43rd, New York, N. Y. (Motor Flashers.) (Thermal Flashers.) Flashing Plugs.)
California Sign Flasher Co., 280 Guttenberg, San Francisco, Cal.
Commercial Elec. Co., 1203 E. Grant, Portland, Ore
Cramblet Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Diamond. See General Appliance Corp.
Dominic. See Kala-Flasher Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electric Signal Corp., 406 Fourth Ave., Seattle, Wash.
Electric Sign Flasher Corp., 1826 W. 9th, Los Angeles, Cal.
Figuregram. See Reynolds Electric Co.
Flash O-Lite. See Betts, Inc., James H.
Flip-Flop. See Betts, Inc., James H.
Gem Engineering Co., Hempstead, N. Y.
Gacor. See General Appliance Corp.
General Appliance Corp., 120 9th, San Francisco, Cal (Flasher Button.)

General Controler Co., 200 E. First, Dayton, O.
Grazier Elec'l Products Co., Johnstown, Pa.
Horni Signal Mfg. Co., 516 Greenwich, New York, N. Y.
Jimbetts. See Betts, Inc., James H.
Kala-Flasher Co., 344 N. Church, Kalamazoo, Mich.
Killark. See Betts & Betts Corp.
Kontroler. See General Controler Co.
Mercury. See Betts, Inc., James H.
Opalume Sign System, Battle Creek, Mich.
Phelps Elec. Co., 29 S. Clinton, Chicago, Ill. (Motorless)
Phoenix Products Co., Phoenix, N. Y.
Presto Products Co., 64 University Place, New York, N. Y. (Sockets and Plugs.)
Reco. See Reynolds Elec. Co.
Reynolds Elec. Co., 2650 W. Congress, Chicago, Ill.
Reynolds Spring Co., Jackson, Mich.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Ryan. See Phoenix Products Co.
Skedoodle. See Phelps Elec. Co.
Sokit. See Betts, Inc., James H.
Thermo-Wynk. See Betts & Betts Corp.
Vacu. See Betts & Betts Corp.
Veebar. See Betts, Inc., James H.
Way, Eugene W., Seattle, Wash.
Wood Electric Co., C. D., 565 Broadway, New York N. Y.
Woodwin. See Wood Elec. Co., C. D.
Wynk-A-Lyte. See Betts & Betts Corp.

FLASHLIGHT LENSES. See Lenses.
FLEXIBLE ARMS. See Tubing, Flexible Metallic.
FLEXIBLE LEADS, Commutator Brush. See Brushes, Commutator.

FLEXIBLE SHAFT MACHINES

(For shafting. See Tubing, Flexible Metallic.)
Strand & Co., N. A., 5001 N. Lincoln, Chicago, Ill.

FORGINGS, Non-Ferrous

Scovill Mfg. Co., Waterbury, Conn.

FORMS, Coil Winding

Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, O.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Master. See Armature Coil Equipment Co.

FORMS, Wire

Forms and Frames for Shade Holders and Shades: Bending, Welding, Forming.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Arrow Wire Frame Corp., 344 E. 23rd, New York, N. Y.
Blake & Johnson Co., Waterbury, Conn.
Central Wire Frame Co., 154 E. 23rd, New York, N. Y. (Complete with socket, cord and plug.)
Chelsea Wire Wks., 675 Hudson, New York, N. Y.
Clark Metal Products Inc., 490 Hancock Ave., Bridgeport Conn.
Electro Weld Co., 70 Munroe, Lynn, Mass.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.
Jeschke Wire Specialty Wks., Crawfordsville, Ind.
Krischer's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Manhattan Wire Products Co., 398 First Ave., New York.
Murray Hill Wire Frame Co., 314 E. 32nd, New York, N. Y.
Roebling's Sons Co., John A., Trenton, N. J.
Steinen & Co., 297 Washington, Newark, N. J.
Watral & Sons, 133 E. 16th, New York, N. Y.
Young Industries, Inc., L. A., Detroit, Mich.

FRAMES, Wire. See Forms, Wire.
FRICTION TAPE. See Tape, Rubber and Friction.
FRINGE, Chandelier. See Crystals, Chandelier.

FUSE CLIPS

Sherman Mfg. Co., H. B., Battle Creek, Mich.
Waterbury Brass Goods Co., Waterbury, Conn.

FUSE TESTERS. See Testers, Fuse and Circuit.

FUSES AND FUSE WIRE

KEY

Cartridge ..... See C
Plug ..... See P
Non-Refillable ..... See N
Refillable ..... See R
Open Link ..... See O
Fuse Wire ..... See O

Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. P
Arkless. See Economy Fuse Mfg. Co.
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. P N
Automatic Elec. Iron & Fuse Co., 215 S. American, Philadelphia, Pa. P
Blue Ribbon. See Royal Elec. Co.
Buss. See Bussman Mfg. Co.
Bussmann Mfg. Co., University & Jefferson Ave., St. Louis C P N R O
Chase-Shawmut Co., Newburyport, Mass. C P N R O
Clearsite. See Economy Fuse & Mfg. Co.
Clear-Top. See Trico Fuse Mfg. Co.
Colortop. See Trico Fuse Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. (Automobile) C N R
Cote Bros. Mfg. Co., 182 W. Lake, Chicago C P R
Crystal. See Royal Elec. Co.
Daum Fuse & Elec. Mfg. Co., 1157 Hodgkiss, Pittsburgh C R
D. & W. See Graybar Electric Co.
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. C P N R
Eco. See Economy Fuse & Mfg. Co.
Electric Fuseguard Co., Charlottesville, Va. C P N R
Elliott Electric Co., Shreveport, La
Gem. See Chicago-Jefferson Fuse & Electric
General Elec. Co., Section W-234 Merchandise Dept., Bridgeport, Conn. C P N R
Graybar Electric Co., Graybar Bldg., Lexington Ave. and 43rd St., New York, N. Y. C
Great Western Fuse Co., 415 Lexington Ave., New York, N. Y. C R
H. & H. See Hart & Hegeman.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. P R
Hudson Wire Co., Ossining, N. Y. O
Kantark. See Trico Fuse Mfg. Co.
Kirkman Engrg. Co., 1 Dominick St., New York, N. Y. C P N O
Littelfuse Laboratories, 1772 Wilson Ave., Chicago, Ill. (Low Capacity, Glass Enclosed. .025 to 2 Amp.) P R
Monarch Fuse Co., Jamestown, N. Y. C N R
National. See Economy Fuse & Mfg. Co.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Pierce Renewable Fuses, Inc., 752 Main, Buffalo, N. Y. C P R O
Platt Bros. & Co., Waterbury, Conn. O
Powell, F. W., 119 W. Ohio, Pittsburgh P R
Ree-Nu-It Elec. Co., New Bedford, Mass. C P R
Rochester Re-Fill Fuse Co., 402 Cottage, Rochester, N. Y. C R
Royal Elec. Co., Chelsea Station, Boston. P N
Shawmut. See Chase-Shawmut Co.
Simplicity. See Cote Bros. Mfg. Co.
Six-In-One. See Industrial Engrg. Co.

Star Fuse Co., 235 Canal, New York, N. Y. C P R
Trico Fuse Mfg. Co., 1001 McKinley Ave., Milwaukee C P N R
Union. See Chicago-Jefferson Fuse & Electric

GALVANIZING

Cattle & Bros., Joseph P., Gaul and Lotterly Sts., Philadelphia, Pa.

GALVANOMETERS. See Instruments, Laboratory Standard.

GAS, Inert

Helium Co., Louisville, Ky.
Palatine Industrial Co., 111 Fifth Ave., New York, N. Y.

GASKETS, Rubber

Gutta Percha & Rubber Mfg. Co., 15 Park Row, New York.
Canfield Rubber Co., Bridgeport, Conn.

GAUZE BRUSHES, Wire. See Brushes, Commutator.
GEARS, Fibre. See Gears and Pinions, Composition.

GEARS (Speed Changing Units)

Cleveland Worm & Gear Co., Cleveland, Ohio.
Cullman Wheel Co., 1346 Altgild, Chicago, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Falk Corp., Milwaukee, Wis.
Farrell-Birmingham Co., 344 Vielcan, Buffalo, N. Y.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago, Ill.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Janette Mfg. Co., 556 W. Monroe, Chicago, Ill.
Jones Fdy. & Machine Co., W. A., Chicago, Ill.
Lipe, W. C., Syracuse, N. Y.
Nuttall Wks., of Westinghouse Elec. & Mfg. Co., McCandless Ave. & Harrison St., Pittsburgh, Pa.
Palmer-Bee Co., Detroit, Mich.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Philadelphia Gear Works, Richmond and Tioga Sts., Philadelphia, Pa.
Smith, Winfield H., Springville, N. Y.

GEARS, Worm

Albaugh-Dover Mfg. Co., Chicago, Ill.
Cleveland Worm & Gear Co., Cleveland, Ohio.
Colburn Gear & Mfg. Co. (Norfolk Downs), Quincy, Mass
Philadelphia Gear Works, Richmond and Tioga Sts., Philadelphia, Pa.

GEARS AND PINIONS, Composition

Celoron Co., Div. of Continental-Diamond Fibre Co., Bridgeport, Pa.
Continental-Diamond Fibre Co., Bridgeport, Pa.
Delaware Hard Fibre Co., Wilmington, Delaware.
Fabroil. See General Elec. Co.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago.
Franklin Fibre Specialty Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
Medart Co., St. Louis, Mo.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Stahl Gear Co., 1390 E. 40th, Cleveland, Ohio
Stranahan Gear Co., Philadelphia, Pa.
Textoil. See General Electric Co.
Textolite. See General Electric Co.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GEARS AND PINIONS, Iron and Steel

Earle Gear & Machine Co., Wayne Junction, Philadelphia.
Falk Corp., Milwaukee, Wis.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Medart Co., St. Louis, Mo.
Meisel Bros. Mfg. Co., 944 Dorchester Ave., Boston, Mass
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Permag. See Perkins Machine.
Tool Steel Gear & Pinion Co., Cincinnati, Ohio.

GEARS AND PINIONS, Rawhide

Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Gerdes & Co., 50 Church, New York, N. Y.
Syracuse Rawhide Mfg. Co., Syracuse, N. Y.
Western Rawhide & Belting Co., Milwaukee, Wis.

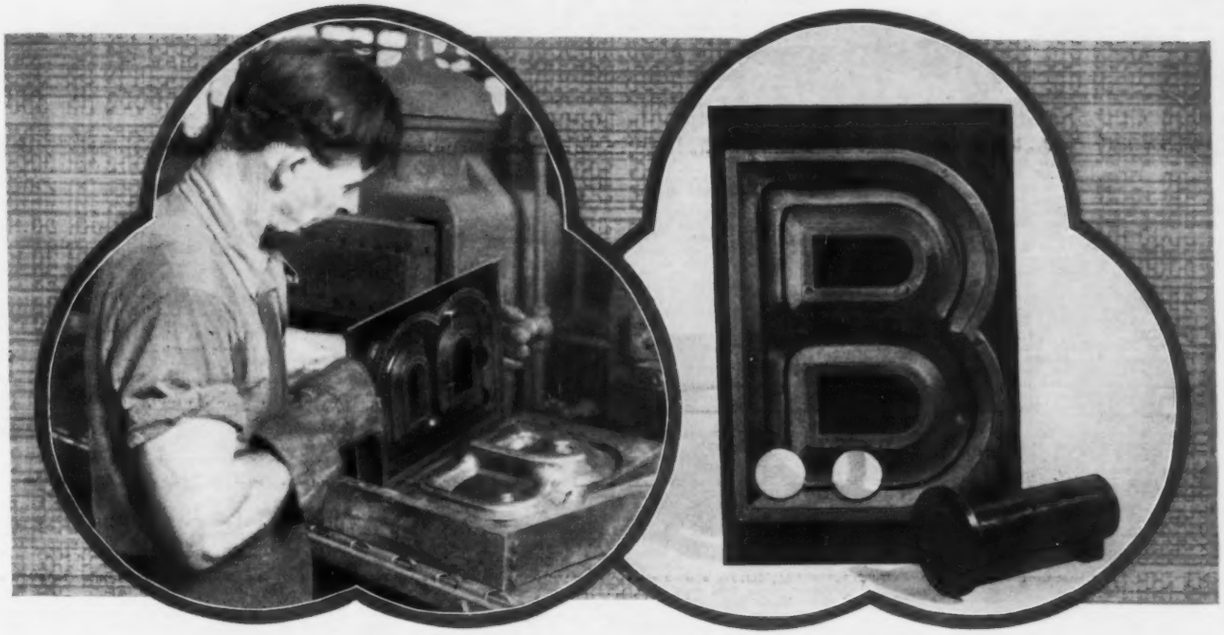
GENERATORS, Electroplating. See Plating Generators
GLASS BULBS. See Bulbs, Glass.
GLASS CANDLES. See Candles, Fixture
GLASS LETTERS. See Letters, Sign.

GLASS for Electrical Purposes

Corning Glass Wks., Corning, N. Y.
Pyrex. See Corning Glass Wks.

GLASSWARE

Alba. See Macbeth-Evans Glass Co.
Amazon. See Gleason-Tiebout Glass Co.
Amelites. See Consolidated Lamp & Glass Co
Apollo. See Gillinder Bros., Inc.
Ardmore. See Jeannette Shade & Novelty Co
Aurene. See Corning Glass Co.
Aurora. See Consolidated Lamp & Glass Co.
Bayley Sons, 105 Vanderveer, Brooklyn, N. Y
Beaumont Co., Morgantown, W. Va.
Bellova. See McFaddin & Co., H. G.
Blanco. See Gleason-Tiebout Glass Co.
Berylite. See Plaut & Co., L.
Bostock, Rhodes & Co., 11 N. Moore, New York, N. Y
Camia. See Gleason-Tiebout Glass Co.
Carara. See Gleason-Tiebout Glass Co.
Celestialite. See Gleason-Tiebout Glass Co
Chesler & Sons Co., J., 45 Varick Ave., Brooklyn, N. Y
Clearcut. See Ivanhoe Division of Miller Co.
Colelite. See Corning Glass Co.
Consolidated Lamp & Glass Co., Coraopolis, Pa
Cora. See Consolidated Lamp & Glass Co.
Cora-Lites. See Consolidated Lamp & Glass Co
Corning Glass Co., Corning, N. Y.
Cremax. See Macbeth-Evans Glass Co
Crystal. See Phoenix Glass Co.
Daylite. See Wells Glass Co.
Delite-White. See Kopp Glass, Inc.
Druid. See Ivanhoe Division of Miller Co
Eagle Mfg. Co., Wellsburg, W. Va.
Emeralite. See McFaddin, H. G.
Equalite. See Bayley & Sons.
Erskine Glass & Mfg. Co., Wellsburg, W. Va
Federal Light & Lens Corp., Star City, W. Va.
Florentine. See Gleason-Tiebout Glass Co.
Glenco. See Ivanhoe Division of Miller Co.
Gillinder Bros., Inc., Port Jervis, N. Y.
Gillinder & Sons, Inc., Philadelphia, Pa.
Gleason-Tiebout Glass Co., 99 Commercial, Brooklyn, N. Y
Gletieco. See Gleason-Tiebout Glass Co.
Havana. See Kopp Glass, Inc.
Hocking Glass Co., Lancaster, O
Holophane Co., 342 Madison Ave., New York, N. Y
Imperial Glass Co., Bellaire, O.
Inland Glass Works, Chicago, Ill.
Ivanhoe Division of Miller Co., Cleveland, Ohio
Ivory. See Phoenix Glass Co.
Ivre. See Ivanhoe Division of Miller Co.
Jeannette Shade & Novelty Co., Jeannette, Pa.
Jefferson Glass Co., Follansbee, W. Va.



Molding process, and Bakelite Molded letter, and housing used by American Neon Light Co., New York

Letters for Neon Signs Made Interchangeable Through use of *Bakelite Molded*

WHEN hand-made letters were used for Neon signs, the lack of uniformity—inseparable from hand work—made interchangeability impossible. Experiments proved that through forming these letters of Bakelite Molded it was possible to obtain extreme accuracy of dimension and perfect interchangeability of any number of letters.

Unlike the hand-made metal letters formerly used, those formed of Bakelite Molded provide a smooth, uniform groove for the Neon tube. The excellent electrical and thermal insulating properties of Bakelite Molded make it possible to fasten the tubes closer to the bottom of the groove, which not only makes reading easier, but also protects the tube itself. With each closing of the molding press, a letter is formed complete with eight threaded bushings firmly embedded. This eliminates several operations formerly required, and a distinct saving in cost is effected.

These Bakelite Molded letters are noncorrosive, unaffected by weather conditions and provide a superior base for painted finishes. Bakelite Molded is also used in these signs for the electrode housings, and for the protecting and insulating bases.

Bakelite Engineering Service

Intimate knowledge of thousands of varied applications of Bakelite Materials combined with eighteen years' experience in the development of phenol resinoids for electrical uses provides a valuable background for the cooperation offered by our engineers and research laboratories. Write for Booklet 52M, "Bakelite Molded."

BAKELITE CORPORATION

247 Park Avenue, New York, N. Y. Chicago Office, 635 West 22nd Street

BAKELITE CORPORATION OF CANADA, LTD., 163 Dufferin Street, Toronto, Ont.

BAKELITE

REGISTERED U. S. PAT. OFF.

THE MATERIAL OF ∞ A THOUSAND USES

"The registered Trade Mark and Symbol shown above may be used only on products made from materials manufactured by Bakelite Corporation. Under the capital "B" is the numerical sign for infinity, or unlimited quantity. It symbolizes the infinite number of present and future uses of Bakelite Corporation's products."

GLASSWARE—Continued
Kaufeld Glass & Ceramic Co., Star City, W. Va.
Kopp Glass, Inc., Swissvale, Pa.
Lumina. See Hocking Glass Co.
Luminite. See Macbeth-Evans Glass Co.
Macbeth-Evans Glass Co., Dept. G, Eastern Division, Charleroi, Pa.
Magnolia. See Phoenix Glass Co.
McFaddin & Co., H. G., 38 Warren, New York, N. Y.
Mellilite. See Gillinder & Sons, Inc.
Micro. See Gillinder & Sons, Inc.
Miller Co., Meriden, Conn.
Monax. See Macbeth-Evans Glass Co.
Moonstone. See Jefferson Glass Co.
N. B. G. See Gillinder & Sons, Inc.
N. U. Glass. See Gillinder & Sons, Inc.
Nebulite. See Gillinder & Sons, Inc.
Nemalite. See Gillinder & Sons, Inc.
Nitro-Glas. See Jefferson Glass Co.
Nuart. See Imperial Glass Co.
Nulite. See Consolidated Lamp & Glass Co.
Nutralux. See Kopp Glass, Inc.
Opalux. See Gleason-Tiebout Glass Co.
Opola. See Inland Glass Co.
Pastella. See Consolidated Lamp & Glass Co.
Pearlone. See Inland Glass Co.
Persian. See Gillinder & Sons, Inc.
Phoenix Glass Co., 230 Fifth Ave., New York, N. Y.
Pilabrasco. See Kopp Glass, Inc.
Pittsburgh Cut Glass Co., Monaca, Pa.
Plaut & Co., L., 432 E. 23rd, New York, N. Y.
Poly-Case. See Gleason-Tiebout Glass Co.
Prestopal. See Gleason-Tiebout Glass Co.
Quezal Glass Mfg. Co., Fresh Pond Rd. and Metropolitan Ave., Brooklyn, N. Y.
Radiant. See Phoenix Glass Co.
Regent. See Ivanhoe Division of Miller Co.
Rezelle. See Ivanhoe Division of Miller Co.
Rosedora. See Consolidated Lamp & Glass Co.
Shade-O-Tone. See Consolidated Lamp & Glass Co.
Snow-White. See Inland Glass Works.
Soloman & Son, Inc., L., 199 Wooster, New York, N. Y.
Star Glass Co., Star City, W. Va.
Sudan. See Ivanhoe Division of Miller Co.
Thebian. See Macbeth-Evans Glass Co.
Translux. See Kopp Glass, Inc.
Trojan. See Ivanhoe Div. of Miller Co.
United Novelty Glass Mfg. Co., 121 Prince, New York, N. Y.
Utopia. See Kopp Glass, Inc.
Velaria. See Ivanhoe Division of Miller Co.
Vineland Flint Glass Wks., Vineland, N. J.
Wells Glass Co., Kokomo, Ind.
Williamsburg Flint Glass Co., 290 Broadway, New York.
Yural. See Ivanhoe Division of Miller Co.
Zanesville Mould Co., Zanesville, O.

GONGS, Unmounted Shells

Bevin Bros. Mfg. Co., East Hampton, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
East Hampton Bell Co., East Hampton, Conn.
Gong Bell Mfg. Co., East Hampton, Conn.
Hill Brass Co., M. N., East Hampton, Conn.
Liberty Bell Mfg. Co., Minerva, O.
Reiter, G. C., Canton, O.

GRAPHITE BEARINGS. See Bearings, Oil-less.
GRID LEAKS. See Radio Circuit Components.
GRIDS, Resistance. See Units, Rods and Grids.
GRILL CLOTH. See Cloth, Untreated.
GRINDERS, Commutator. See Tools, Commutator Truing.
GROMMETS. See Eyelets.
GROUND LOCATORS. See Instruments, Portable and Switchboard: also Testers, Coil.
GROWLERS, Armature. See Testers, Coil.

HANDLES, Wood; For Switches or Sad Irons

Allen, Chas. E., Pequabuck, Conn.
American Enamel Co., 20 Neville, Providence, R. I.
Bogert & Hopper, 225 Varick, New York, N. Y.
Estes & Son, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Fitchburg Enamel Co., Fitchburg, Mass.
Flanders Hardware Co., North Weare, N. H.
Fuller, J. J. Westfield, Mass.
Narragansett Mach. Co., Pawtucket, R. I.
National Wood Process, New Bedford, Mass.
Novelty Turning Co., Norway, Me.
Ober Mfg. Co., Chagrin Falls, O.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, O.
Pique Handle & Mfg. Co., Pique, Ohio.
Royal Enamel Co., Fitchburg, Mass.
Schutz Bros., 152 Chambers, New York, N. Y.
Stiles & Co., H. A., 174 Portland, Boston, Mass.
Stratton Mfg. Co., Stratton, Maine.
Sun Enamel Wks., Leominster, Mass.

HOLDERS, Brush. See Brushes, Commutator.
HOT WIRE METERS. See Instruments, Portable and Switchboard.
IMPREGNATING COMPOUNDS. See Wax and Compounds.
IMPREGNATING, VACUUM. See Ovens, Industrial.
INCANDESCENT LAMP BULBS (Unfinished). See Bulbs, Glass.
INCANDESCENT LAMP FILAMENTS. See Filaments, Incandescent Lamp.

INDICATORS, Operation

Operation and Cost Indicators for Manager's Office.
Bristol Co., Waterbury, Conn. (Elapsed Time Recorder.)
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa
Production Meter Co., 1315 S. Wabash Ave., Chicago, Ill

INDUCTION COILS. See Coils, Finished.
INSTRUMENT, Jewels. See Jewels.
INSTRUMENTS, Laboratory Standard. See Instruments, Laboratory Standard.
INSTRUMENTS, Portable Testing. See Instruments, Portable and Switchboard: also Instruments, Pocket.

INSTRUMENTS, Laboratory Standard

Beck Bros., 3640 N. Second, Philadelphia, Pa.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Burt, R. C., 327 Michigan Ave., Pasadena, Cal. (Oscilloscopes.)
Cambridge Instrument Co., Ossining, N. Y.
Chicago Apparatus Co., 1735 N. Ashland Ave., Chicago, Ill
Eppley Laboratory, Newport, R. I. (Standard Cells.)
Fahy. See Rubicon Co.
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnsen, Philadelphia, Pa
Hikok Elec'l Instrument Co., 10514 Dupont, Cleveland, O
Jagabi. See Biddle, James G.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kasson. See Rawson Elec'l. Instrument Co.
Kelvin. See Leeds & Northrup Co.
Kohlrausch. See Leeds & Northrup Co.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa
Milvay. See Chicago Apparatus Co.
Osino. See Westinghouse Electric & Mfg. Co.
Radio Elec'l Wks., 50 W. 22nd, New York, N. Y.
Rawson Elec'l Instrument Co., Cambridge, Mass.
Roller-Smith Co., 289 Broadway, New York, N. Y
Rubicon Co., 29 N. Sixth, Philadelphia Pa. (Wheatstone Bridges, Galvanometers, Inductance Condensers, Potentiometers, Resistance Boxes, Permeameters.)
Simplex. See Leeds & Northrup Co.
Strobatchy. See Radio Elec'l Wks.

Thompson-Levering Co., 351 N. 57th St., Philadelphia, Pa
Vawter. See Thompson-Levering Co.
Unipivot. See Rawson Elec'l Inst. Co.
Vreeland Apparatus Co., 140 Cedar, New York, N. Y. (Sine Wave Oscillators.)
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J.

INSTRUMENTS, Pocket

Advance. See Eldredge Elec'l Corp.
Adbro Mfg. Co., 927 French, Pittsburgh, Pa.
Eclipse. See Eldredge Elec'l Corp.
Eldredge Elec'l Corp., 3 P. O. Sq., Springfield, Mass.
Ideal Instrument Co., Penacook, N. H.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Lundquist Tool & Mfg. Co., Worcester, Mass.
Milavolt. See Adbro Mfg. Co.
Readrite Meter Works, 7 College Ave., Bluffton, Ohio.
Roller-Smith Co., 289 Broadway, New York, N. Y.
Shire Elec. Products Co., Marquette Bldg., Detroit, Mich.
Sholder-Excel Mfg. Co., Clyde, Ohio.
Square D Company, Detroit, Mich.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J.
Wigginton. See Square D Company.
Yankee. See Lundquist Tool Mfg. Co.

INSTRUMENTS, Portable and Switchboard

This heading includes all standard, portable and switchboard types, measuring and testing instruments—ammeters, voltmeters, wattmeters, ohmmeters, cable testers and fault-finders.
See Also Instruments, Pocket; Also Instruments, Laboratory Standard.
Beck Bros., 421 Sedgley Ave., Philadelphia, Pa.
Beede Instrument Co., Penacook, N. H.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne and Windrim Sts., Philadelphia, Pa.
Cambridge Instrument Co., Ossining, N. Y.
Dongan Electric Mfg. Co., 2985 Franklin, Detroit, Mich.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Electric Mfg. Co., 966 Mission, San Francisco, Cal.
Esterline-Angus Co., Speedway, Indianapolis, Ind.
Fidelity Electric Co., Lancaster, Pa.
Fisher Cable Test Set. See Leeds & Northrup.
Fore Elecl. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo.
Freyn Engrg. Co., 310 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa.
Ground-Ohmer. See Sticht & Co.
Handy. See Weinberg & Co.
Hickok Elecl. Inst. Co., 10514 Dupont, Cleveland, O.
Hoyt Elecl. Inst. Wks., 857 Boylston, Boston, Mass.
I T L. See Illinois Testing Laboratories.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Master. See Jewell Elecl. Instrument Co.
M. D. C. See Metropolitan Devices Corp.
Megger Testing Sets. See Biddle.
Metropolitan Devices Corp., 1259 Atlantic Ave., Brooklyn
Multi-Volt Trouble Finder. See Welford, Jr., Geo. W.
Nagel Elecl. Co., W. G., 23 St. Clair, Toledo, Ohio.
Norton Elecl. Inst. Co., 81 Hilliard, Manchester, Conn.
Paneltest Meters. See Beede Instrument Co.
Peerless Meters. See Thompson-Levering Co.
Pier Equipment Mfg. Co., Benton Harbor, Mich.
Pin-Jack. See Weston Elec'l Instrument Co.
Price Hollister Co., Rockford, Ill.
Queen. See Gray Instrument Co.
Radio Electric Works, 150 West 22nd St., New York, N. Y.
Rawson Elecl. Inst. Co., Cambridge, Mass.
Roller-Smith Co., 289 Broadway, New York, N. Y.
Sangamo Elec. Co., Springfield, Ill.
Shortfinder. See Eisemann Shortfinder Co.
Standee. See Sticht Co., H. H.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Sticht & Co., H. H., 13 Park Row, New York, N. Y.
Tanner Engrg. Co., Rawson St. and Nelson Ave., Long Island City, N. Y.
Test-A-Bat. See Beede Instrument Co.
Thompson-Levering Co., 351 N. 57th., Philadelphia, Pa.
Thomson. See General Electric Co.
Triplex Meters. See Roller-Smith Co.
3 in 1. See Sticht & Co., H. H.
Two-in-One. See Stitcht Co., Herman H.
United States Gauge Co., 44 Beaver, New York, N. Y.
Utility. See Esterline-Angus Co.
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J.

INSULATION (Insulating) (Insulators)

Beads. See Beads, Insulating.
Canopy. See Insulators, Canopy.
Cloth. See Cloth & Paper.
Composition. See Molded Insulation.
Compound. See Wax and Comp.
Fibre. See Fibre.
Lava. See Coves, Resistance Coil.
Marble. See Slate
Mica. See Mica.
Molded. See Molded Insulation.
Paint. See Paint, Varnish, Laquer.
Paper. See Cloth and Paper Insulating.
Phenolic. See Fibre, Phenol. Also Molded Insulation.
Porcelain. See Porcelain.
Rod. See Rubber, Hard.
Rubber. See Rubber, Hard.
Sealing Wax. See Wax and Compounds.
Slate. See Slate.
Soapstone. See Soapstone.
Tubing. See Tubing, Varnished Fabrics.
Varnish. See Paint and Varnish.
Wax. See Wax and Compounds.

INSULATING MACHINES, WIRE. See Wire Manufacturing Machines.
INSULATING TUBING. See Tubing, Varnished Fabric; also Tubing, Rubber.

INSULATION CUTTERS

Artos Engrg. Co., Milwaukee, Wis.

INSULATION MIXERS

Baker Perkins Co., Saginaw, Mich.

INSULATION SHEARS. See Shears, Insulation.
INSULATION STRAINING MACHINES. See Wire Manufacturing Machines.
INSULATION TESTERS. See Instruments, Laboratory Standard.

INSULATORS, Canopy

Continental-Diamond Fibre Co., Bridgeport, Pa.
Franklin Fibre Specialty Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
Knu. See Stanley, Arthur F.
Macallen Co., Boston 27, Mass.
Stanley, Arthur F. 150 Varick, New York, N. Y.
Wilmington Fibre Specialty Co., Wilmington, Del.

IRON CASTINGS. See Castings, Gray Iron.

IRONS, Soldering. See Soldering Irons.
JACKS, Armature. See Lifts, Armature.
JACKS, Radio. See Radio Receiver Parts.

JARS, Battery, Glass

For Composition Jars. See Molded Insulation; also Rubber.
Corning Glass Co., Corning, N. Y.
Cumberland Glass Mfg. Co., Bridgeton, N. J.
Gaynor Glass Works, Salem, N. J.
Gillinder & Sons, Inc., Philadelphia, Pa.
Hazel-Atlas Glass Co., Wheeling, W. Va.
Macbeth-Evans Glass Co., Dept. G, Eastern Division, Charleroi, Pa.
Rodefer Glass Co., Bellaire, O.
Sneath Glass Co., Hartford City, Ind.
United States Glass Co., 9th & Bingham, Pittsburgh, Pa.

JEWELS, Instrument Bearing

Bird, Richard H., Waltham, Mass.
Deknatel & Sons, J. A., Queens Village, N. Y.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Fisher, Thomas E., Penacook N. H.
Gatti, Inc., Aurele M., Liberty St. & Fairmount Ave., Trenton, N. J.
Moser Jewel Co., Perth Amboy, N. J.
Mildrum Jewel Co., East Berlin, Conn.
Sapphire Products Co., 51 Chambers, New York, N. Y.
Wennstrom's Sons Co., John, Suffern, N. Y.
Worley Jewel Co., John, Waltham, Mass.
Universal. See Oefinger, J. L.

JOINTS, Fixture Insulating

Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill.
Macallen Co., Boston 27, Mass.
Sandow Tool Co., 1440 Broadway, New York, N. Y.
Sprecher Mfg. Co., P. W., 3220 North Ave., Milwaukee.
White Co., O. C., 15 Hermon, Worcester, Mass.
Wittenberg Bros., 60 Shipman, Newark, N. J.

LABORATORY (Laboratories.)
Ovens. See Ovens, Industrial & Laboratory.
Rheostats. See Rheostats.
Testing. See Testing.

LABORATORY STANDARD INSTRUMENTS. See Instruments, Laboratory Standard.
LACQUER, ARMATURE. See Paint, Varnish and Lacquer.
Metal. See Paint, Varnish and Lacquer.
LAMINATIONS. See Discs, Armature.
LAMP BASES. See Bases, Reading Lamp.
LAMP BULBS (Unfinished). See Bulbs, Glass.
LAMP FILAMENTS. See Filaments, Incandescent Lamp.
LAMP LEAD-IN WELDS. See Filaments, Incandescent Lamp.
LAMP TESTING PHOTOMETERS. See Photometers, Lamp Testing.

LATHES

(Special for use in Motor Repairing and Motor Mfg.—Test Bench Lathes).
Ajax Electric Co., Kalamazoo, Michigan.
Allen Electric & Equipment Co., Kalamazoo, Michigan
Cincinnati Lathe & Tool Co., 3207 Disney (Oakley) Cincinnati, Ohio.
Hobart Bros. Company, Troy, Ohio. (Test Bench).
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

LAVA. See Coves, Resistance Coil.

LEAD

American Lead Co., 3112 Penn Ave., Pittsburgh, Pa.
Blatchford Co., E. W., 608 Dearborn, Chicago, Ill.
Columbia Smelting & Refining Wks., 365 West, New York, N. Y.
DuBois & Co., Frederick N., 152 Riverside Ave., Newark, N. J.
Eagle-Picher Lead Co., 134 N. LaSalle, Chicago, Ill.
Federated Metals Corp., Woolworth Bldg., New York, N. Y.
Jacobson & Son Co., I. M., 15304 Idaho, Detroit, Mich.
National Lead Co., 111 Broadway, New York, N. Y.
Raymond Lead Co., 735 S. Washtenam Ave., Chicago, Ill.
Turner Lead Co., East St. Louis, Ill.

LEAD-IN WELDS, Lamp. See Filaments, Incandescent Lamp.
LEADS, FLEXIBLE (Commutator Brush). See Brushes, Commutator.

LENSES

Sign Letter, Flashlight, Projector and Reflector Lenses Also glass caps, jewels and bezels for all electrical devices See also Jewels, Instrument Bearing.
Bausch & Lomb Optical Co., 635 St. Paul, Rochester, N. Y. (Condensing and Projection Lenses.)
B. B. T. Corp. of America, Atlantic Bldg., Philadelphia, Pa.
Corning Glass Wks, Corning, N. Y. (Flashlight and Signal.)
Deknatel & Sons, J. A., Queens Village, N. Y.
Gilligan Glass Products Co., New Philadelphia, Ohio.
Goerz American Optical Co., C. P., 317 E. 34th, New York.
Jefferson Glass Co., Follansbee, W. Va. (Sign and Flashlight.)
Kliegl Bros. Universal Stage Lig. Co., 321 W. 50th, New York, N. Y. (Condensing and Projector.)
Macbeth Evans Glass Co., Dept. G, Eastern Division, Charleroi, Pa. (Flashlight.)
North Light Corp., 30 W. 15th, New York, N. Y.
Popper & Sons, Leo, 147 Franklin, New York, N. Y.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill.
Rochester Glass Products Co., 29 N. Water, Rochester, N. Y.
Rodefer Glass Co., Bellaire, O. (Flashlight.)
Sneath Glass Co., Hartford City, Ind. (Sign.)
Stromberg-Carlson Telephone Mfg. Co., 1050 University Ave., Rochester, N. Y.

LETTERS, Sign

Glass. Metal.
Adsign Corp, 113 W. 63rd, New York, N. Y.
Chain Products Co., 3924 Cooper Ave., Cleveland, O. (Brass and White Metal.)
Chicago Miniature Lamp Co., 652 W. Lake, Chicago, Ill. (Raised Letters for Signs.)
Eradium. See Pioneer Corporation.
Federal Elec. Co., 6700 S. State, Chicago, Ill. (Metal.)
Grammes & Sons, Inc., L. F., Allentown, Pa.
Heralite. See Pressed Prism Plate Glass Co.
Kolux Glass Sales Co., Kokomo, Ind.
Lu-Mi-Nus Signs, Inc., 2736 Wentworth Ave., Chicago, Ill.
Manhattan Elecl. Supply Co., 190 Sixth Ave., New York, N. Y. (For Gas Signs.)
Opalite Corp., 201 E. Ohio, Chicago, Ill.
Pioneer Corporation, 8308 Yale Ave., Chicago. (Luminous.)
Pressed Prism Plate Glass Co., Chicago, Ill. (Glass.)

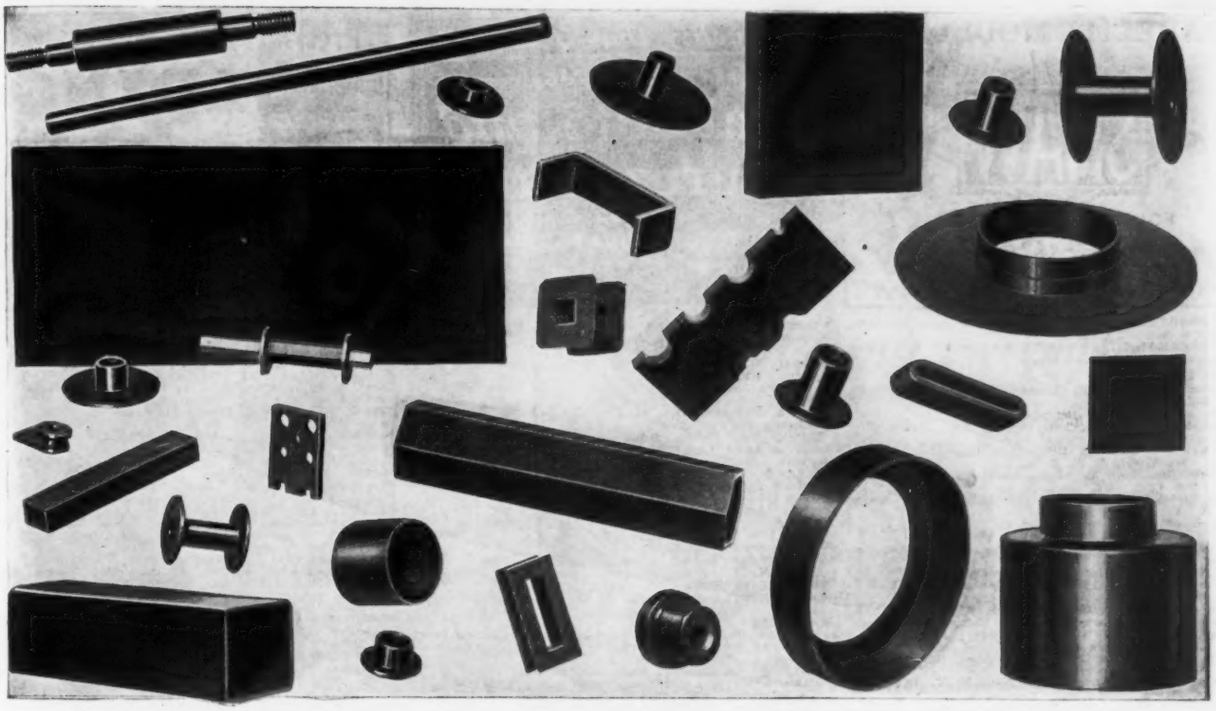
LIFTS, Armature

Lifts, Hoists, Jacks, Trucks, Buggies, Floor Cranes.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Co., Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridion Company, Frank, Boston, Mass.

LININGS, Socket

Remington Mfg. Co., 937 Barnum Ave., Bridgeport, Conn.

LOCK WASHERS. See Washers, Lock.



For Complete Satisfaction Specify Textolite Laminated

Textolite laminated gives complete satisfaction to users, not only because of its remarkable combination of qualities, but also because it is made by an organization with facilities and resources to supply all your present and future needs.

It is new to the trade—but it is time-tried in seven years of service. Millions of pounds have been used to replace wood, rubber, fiber, mica, porcelain, and metals in General Electric products.

Its quality is beyond question—the resources of the General Electric research laboratories are enlisted in its manufacture. Modern machinery, supervised by skilled technicians, assures quantity production.

The adaptability of Textolite laminated is amazing. The trade continually finds new uses for it. Complete stocks of rod, tube, and plate are always on hand, and special requirements can be met promptly.

885-19

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

BAKELITE MOULDERS

SHAW

FOUNDED 1892

Insulator Company

IRVINGTON, NEWARK, NEW JERSEY

LOOP WINDERS & SPREADERS. See Winding Machines, Armature & Field Coil.
LOUD SPEAKER DIAPHRAGMS MATERIAL. See Cloth Untreated; also Parchment Paper.

LOUD SPEAKERS

Manufacturers Units and Electric Pick-ups for Portable and Built-in Types.

Amervox. See American Reproducer Co.
American Reproducers Co., 1204 Summit Ave., Jersey City, N. J.
A. R. C. See American Reproducers Co.
Amplion. See Woolf, J. W. & W. L.
Baisa Wood Reproducer Corp., 331 Madison Ave., New York.
Brielle. See Penn Mfg. Co.
Brooklyn Metal Stamping Corp., 720 Atlantic Ave., Brooklyn, N. Y. (Electric Pick-up.)
Cannonball. See Cannon & Miller Co.
Cannon & Miller Co., Springwater, N. Y.
Chelten Electric Co., 4859 Stanton Ave., Philadelphia, Pa
Conamic. See Operadio Mfg. Co.
Decatur Mfg. Co., 45 Harman St., Brooklyn, N. Y.
Dreher & Son, Chas., 157 Spring, New York, N. Y.
Dymac. See Electrical Products Mfg. Co.
Electrical Products Mfg. Co., Providence, R. I.
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill. (Units.)
Empire United Hat Block Co., 312 E. 12nd, New York.
Engineers Service Co., 25 Church, New York, N. Y. (Kit.)
Ensco. See Engineers Service Co.
Fenco Cone Co., 87 Murray, New York, N. Y. (Kit.)
Fergus Co., 235 Elizabeth Ave., Newark, N. J.
Fidelity Radio Corp., Salt Lake City, Utah.
F. & H. Radio Laboratories, Fargo, N. D.
Globe Technolian Corp., Reading, Mass.
G. R. P. See Penn Mfg. Co.
Grutal Speaker Co., 609 E. Walnut, Des Moines, Iowa.
Jensen Radio Mfg. Co., 338 N. Kedzie Ave., Chicago, Ill
Kersten Radio Equipment, Inc., 1415 Filliford, Kalamazoo Mich.
Kyle. See Newcombe-Hawley.
Lata Baisa. See Baisa Wood Reproducer Corp.
Magnavox Co., 4250 Horton, Oakland, Cal. Also Units.
Marlone Radio Mfg. Co., 303 Devoe, Brooklyn, N. Y (Horn.)
Mire [illegible] Co., 191 Joralemon, Brooklyn, N. Y.
Minuet. See Thompson Radio Co.
Molded Wood Products, 219 W. Chicago Ave., Chicago, Ill
Mozart-Radioceive. See Fergus Co.
Newcombe-Hawley Lab. of United Reproducers Corp., St Charles, Ill.
Newton Elec'l Mfg. Co., Newton, Mass.
O'Neil Mfg. Corp., West New York, N. J.
Operadio Mfg. Co., St. Charles, Ill.
Peerless. See United Radio Corp.
Penn Mfg. Co., G. R., 231 Mercer, New York, N. Y.
Philadelphia Storage Battery Co., Ontario & C Sts., Philadelphia, Pa.
Philco. See Philadelphia Storage Battery Co.
Platter Cabinet Co., North Vernon, Ind.
Powerola. See Temple Corp.
Puronewer. See Platter Cabinet Co.
Quam Radio Corp., 9703 Cottage Grove Ave., Chicago, Ill
Racon Elec. Co., 18 Washington Place, New York, N. Y (Horn only.)
Radio Cabinet Co., 2118 Gale, Indianapolis, Ind.
Red Lion Cabinet Co., Red Lion, Pa.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Swcboda Co., Maritime Bldg., Seattle, Wash.
Temple Corp., 5253 W. 65th, Chicago, Ill.
Thompson Radio Co., 25 Church, New [illegible]k, N. Y.
Ultratone Mfg. Co., 1046 W. Van Buren, Chicago, Ill
United Radio Corp., 25 Leighton Ave., Rochester, N. Y.
Universal. High Power Telephone Co., Carleton Ave. and Eddy, Seattle, Wash.
Utah Radio Products Co., 1615 S. Michigan Ave., Chicago Ill. (Also Piano Unit.)
Victor Radio Corp., 4321 N. Western Ave., Chicago, Ill.
Wondrphone. See Universal High-Power Telephone Co.
Woolf, J. W. & W. L., 133 W. 21st, New York, N. Y.
Wright-De Coster, Inc., St. Paul, Minn.
Zisch Engineering Corp., Newark, N. J.

LUGS, Copper

Anderson Mfg. Co., Albert & J. M., 289 A St., Boston Mass.
Dante Elecl. Mfg. Co., Bantam, Conn.
French Mfg. Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Wolverine Tube Co., 1433 Central Ave., Detroit, Mich

LUMINOUS SPECIALTIES

KEY

Luminous Compound ..... See C
Pendants (Bulbs) ..... See P
Standard Parts ..... See S

Acornlite Studios, 675 72nd, Brooklyn, N. Y. ..... P
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... S P
Bryant Electric Co., Bridgeport, Conn. ..... P
Connecticut Elec. Mfg. Co., Bridgeport, Conn. ..... S

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Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.
Eagelite. See Eagle Elec. Mfg. Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y. ..... P
General Electric Co., Section W-234, Merchandise Dept., Bridgeport, Conn. ..... S P
Glow Lite. See Rodale Mfg. Co.
Glow Tip. See Arrow Electric Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Electric Co., Hartford, Conn. ..... S P
Hubbell, Inc., Harvey, Bridgeport, Conn. ..... P
Luma & Luma Lite. See Radium Dial Co.
Radieye. See General Electric Co.
Radium Dial Co., 3532 Forbes, Pittsburgh, Pa. .... C P
Reynolds Spring Co., Jackson, Mich. ..... S
Rodale Mfg. Co., 200 Hudson, New York, N. Y. ..... P
Seelite. See T. C. Smith & Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia .. P
Spot O Lite. See Hart & Hegeman Mfg. Co.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y. ..... C S P

MACHINE SCREWS. See Screws, Machine.
MACHINE SCREW PRODUCTS. See Screw Machine Products.

MACHINES

Armature Banding. See Banding Machines, Armature
Armature Notching. See Notching Machines, Armature
Balancing. See Balancers, Armature.
Banding. See Banding Machines, Armature.
Cable Armoring. See Wire Manufacturing Machines
Coil Shaping. See Shaping Machines, Coil.
Coil Taping. See Taping Machines, Coil.
Coil Winding. See Winding Machines.
Commutator Slotting. See Mica Undercutters.
Engraving. See Engraving Machines.
Incandescent Lamp Making. See Machines, Lamp Making
Molded Insulation. See Presses, Molded Insulation.
Perforating. See Perforating Machines.
Porcelain Molding. See Presses, Porcelain Molding
Radio Tube. See Machines, Lamp Making.
Shaping. See Shaping Machines, Coil.
Slotting. See Mica Undercutters.
Soldering. See Soldering Machines, Commutator.
Spring Making. See Spring Making Machines.
Taping. See Taping Machines, Coil.
Tension. See Tension Machines, Band Wire.
Winding. See Winding Machines
Wire, Armoring. See Wire Manufacturing Machines.
Wire Drawing. See Wire Drawing Machinery.
Wire Insulator. See Wire Manufacturing Machines
Wire Measuring. See Wire Manufacturing Machines
Wire Tension. See Tension Machines, Band Wire
Wire Wrapping. See Wire Wrapping Machines.

MACHINES, Lamp Making

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Berrenberg, R., 12 Farnham (Roxbury), Boston, Mass (Vacuum Pumps.)
Dwyer Machine Co., Lynn, Mass.
Eisler Engineering Co., 770 S. 13th, Newark, N. J.
General Engineering & Supply Co., 160 5th Ave., New York, N. Y. Filament Winder.
Gesco. See General Engineering & Supply Co.
Sleeper & Hartley, Inc., Worcester, Mass.
York Elec. & Machine Co., 30 Penn, York, Pa.

MACHINES, Spring Making. See Spring Making Machines
MACHINES, WIRE MANUFACTURING. See Wire Manufacturing Machines.
MAGNET CHARGERS. See Chargers, Magnet.
MAGNET STEEL. See Steel, Magnet.
MAGNET TESTERS. See Instruments, Portable and Switchboard; also Instruments, Pocket.
MAGNET WIRE MACHINES. See Enameling Machines for Magnet Wire.
MAGNETIC CHUCKS. See Chucks, Magnetic.
MAGNETIC CLUTCHES. See Clutches, Magnetic.
MAGNETOMETERS. See Instruments, Pocket.

MAGNETS, Permanent

Bulleus Co., D. K., Pottstown, Pa.
Ind. Steel Products Co., 4545 S. Western Blvd., Chica.
Rogers Drop Forging Co., Worcester, Mass.
Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.
Stiebi & Co., H. H., 13 Park Row, New
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.

MALLETS, Raw Hide

Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill
Crude Pelt. See Chicago Rawhide Mfg. Co.
Holbrook Raw Hide Mfg. Co., 748 N. Main, Providence, R. I

MANGANESE, Battery. See Chemicals, Battery.
MEASURING INSTRUMENTS. See Instruments.
METAL CUTTING OUTFITS. See Welding and Cutting
MECHANICAL RUBBER GOODS. See Rubber Mechanical Goods.
MEGOHMMETERS. See Instruments, Laboratory Standard
MERCURY SWITCHES. See Switches, Mercury.
METAL CLEANERS (Compound). See Cleaners, Metal Outfits.
METAL FINISHING. See Plating & Finishing.
METAL MARKING OUTFITS. See Engraving Machines
METALLIC SHADES. See Shades, Metallic.
METERS. See Instruments.
MICA SHADES. See Shades, Mica.
MICA TAPE. See Tape, Mica.
MICA UNDERCUTTERS. See Slotting Machines & Tools Commutator.

MICA

Asheville Mica Co., Biltmore, N. C.
Asco. See Schoonmaker Insulation Co.
Brand & Co., William, 268 Fourth Ave., New York, N. Y.
Chicago Mica Co., 345 Campbell, Valparaiso, Ind.

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Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y
Gerdau Co., Otto, 533 Canal, New York, N. Y.
Hirsch Mica Co, 1087 Flushing Ave., Brooklyn, N. Y.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
International Mica Co., 3660 Brandywine, Philadelphia, Pa
Kant Krack. See Huse Liberty Mica Co.
Keene Mica Co., Keene, N. H.
Macallen Co., Boston 27, Mass.
Micabond. See Chicago Mica Co.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Miralite. See Mitchell-Rand Mfg. Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Micanite. See Mica Insulator Co.
Mica Products Mfg. Co., 54 Greene, New York, N. Y.
Munsell & Co., Eugene, 200 Varick, New York, N. Y.
Nemco. See New England Mica Co.
New England Mica Co., Waltham, Mass.
New England Minerals, Inc., 85 Devonshire, Boston, Mass
New York Mica & Mfg. Co., Auburn, N. Y.
Peerless. See New England Mica Co.
Prestonite. See Robt. K. Preston Mica Co.
Preston Mica Co., Robt. K., 957 Monadnock Blk., Chicago. (Ground Mica.)
Red Streak. See Huse Liberty Mica Co.
Rogers-Pyatt Shellac Co., 81 Water St., New York. (Imp.)
Schoonmaker Insulation Co., A. O., 34 University Place, New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co., Plumtree, N. C.
Watson Bros., 170 Purchase, Boston, Mass.

MINIATURE SWITCHBOARD SYSTEMS. See Instruments, Portable and Switchboard.
MIXERS, INSULATION. See Insulation Mixers.

MOLDED

Presses. See Presses, Molded Insulation.
Radio Parts. See Radio Molded Parts.
Shades. See Molded Insulation.

MOLDED INSULATION

Alco. See American Insulator Corp.
Allen & Hills, Inc., Auburn, N. Y.
American Insulator Corp., New Freedom, Pa.
American Machine & Foundry Co., 5520 Second Ave., Brooklyn, N. Y.
Amerine. See American Insulator Corp.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Asbestos Shingle Slate & Sheathing Co., Ambler, Pa. (Cold.)
Auburn Button Wks., Auburn, N. Y.
Bakelite Corp., 247 Park Ave., New York, N. Y.
Bay State Moulding Co., 1197 Dorchester Ave., Boston.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Beldenmold. See Belden Mfg. Co.
Bell Mfg. Co., 11 Elkins, Boston, Mass. Radio Parts.
Boonton Molding Co., Boonton, N. J.
Boonton Rubber Mfg. Co., 223 Fanny Rd., Boonton, N. J.
Brr-lite Moulding Corp., 109 Hudson, Jersey City, N. J. (Wood Composition.)
Celoron Co. Div. of Continental-Diamond Fibre Co., Bridgeport, Pa.
Cetelite. See Connecticut Molded Products Corp.
Cetec. See Connecticut Molded Products Corp.
Cepco. See Connecticut Molded Products Corp.
Coltrock See Colt's Patent Firearms Mfg. Co.
Charmond Elec. Corp., 30 Church, New York, N. Y
Chicago Molded Products Co., 2149 Walnut, Chicago, Ill.
Cincinnati Molding Co., 2037 Florence Ave., Cincinnati, O.
Colasta Co., Hoosick Falls, N. Y.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Compo-Site, Inc., 207 Astor, Newark, N. J.
Condensite. See Bakelite Corp.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Connecticut Molded Products Corp., Meriden, Conn. (Cold.)
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Dayton Insulating Molding Co., 434 E. First, Dayton, Ohio
Diemoulding Production Co., Canastota, N. Y.
Dimec. See Dayton Insulating Moulding Co.
Durez. See General Plastics, Inc.
Electrose. See Insulation Mfg. Co.
Erinold Co., Park Row Bldg., New York, N. Y
Everoyal. See Bakelite Corp.
Formica Insulation Co., 4638 Spring Grove Ave., Cincinnati, O.
Garfield Mfg. Co., Garfield, N. J. Composition. (Cold.)
General Electric Co., Schenectady, N. Y.
General Moulded Composition Co., 212 Market, Lynn, Mass.
General Plastics, Inc., 59 Walck Rd., N. Tonawanda, N. Y.
Gummor. See Garfield Mfg. Co.
Hahn Mfg. Co., Harry W., 623 S. San Pedro, Los Angeles, Cal.
Herculite. See Colosta Co.
Hi-Heat. See Insulation Mfg. Co.
Imperial Molded Products Co., 2925 W. Harrison, Chicago
Imrreco. See Insulation Products Co.
Inda. See American Machine & Foundry Co.
Insulation Mfg. Co., New York Ave. and Herkimer St Brooklyn, N. Y
Insulation Products Co., Richland, Pittsburgh, Pa.
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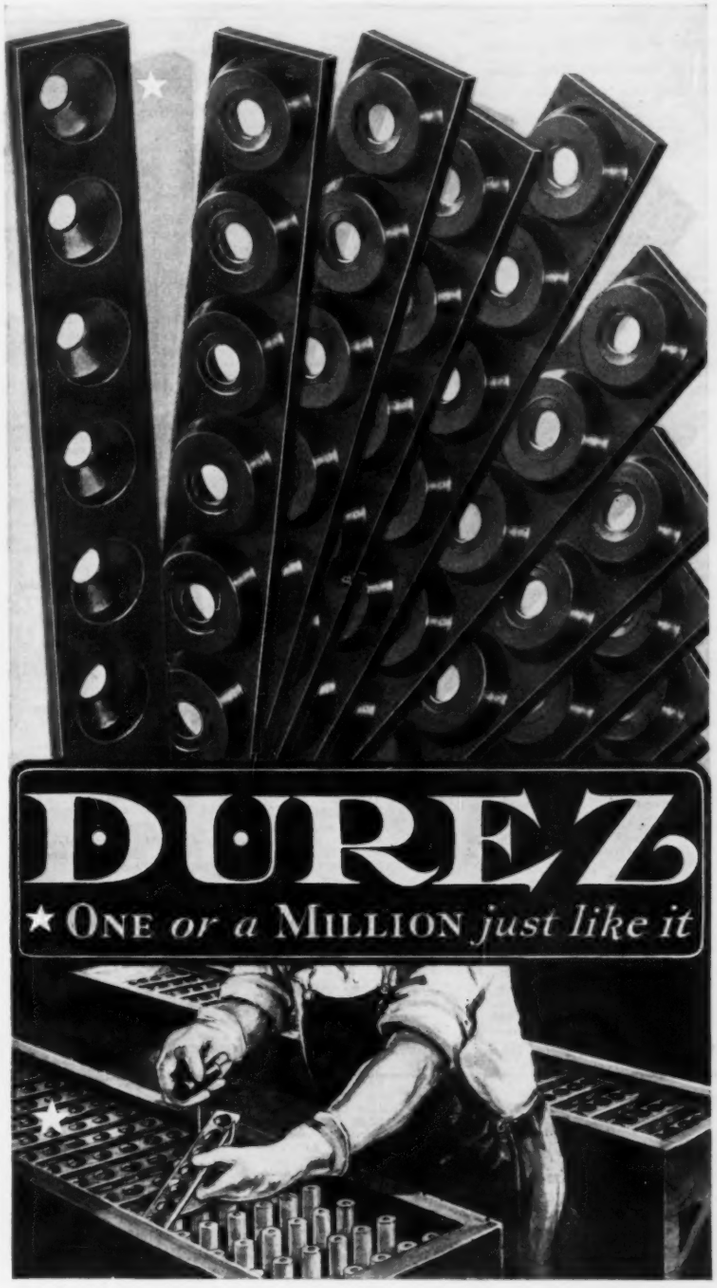

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Karolith Corp., 189 13th, Long Island City, N. Y. (Casein plastics.)
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Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Klagges, Chas., 128 147th, Ozone Park, N. Y.
Kuhn & Jacob Machine & Tool Co., 502 Prospect Ave., Trenton, N. J.
Kurz-Kasch Co., Dayton, O.
Lacanite. See Scranton Button Co.
Macallen Co., Boston, 27, Mass.
Mack Molding Co., Little Falls, N. J.
Makalot. See Johnson Molding & Tool Co.
Manchester Mfg. Co., Manchester Depot, Vt.
Megohom. See Waterbury Button Co.
Micarta Fabricators, Inc., 309 Canal, New York, N. Y.
Micarta. See Westinghouse Elec. & Mfg. Co.
Modern Molded Products Co., Blount and Elm Sts., Providence, R. I.
New England Products Co., 232 Greenwich, New York, N. Y.
Niagara Insul-Bake Specialty Co., 483 Delaware Ave., Albany, N. Y.
Nixon Nitration Works, Nixon, N. J.
Nixonoid. See Nixon Nitration Works.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Norloc. See Norton Laboratories, Inc.
Northern Industrial Chemical Co., 11 Elkin, South Boston.
Norton Laboratories, Inc., 1025 Mill, Lockport, N. Y.
Panelyte Corp., Trenton, N. J.
Paramix. See Splitdorf Radio Corp.
Paratherm. See Scranton Button Co.
Phenolic. See Scranton Button Co.
Pruven Composition Products Corp., Milford, Conn.
Pruvenite. See Pruven Composition Products Co.
Pyrolax. See Cutler-Hammer Mfg. Co.
Recto Mfg. Co., 23 W. 3rd, Cincinnati, O.
Redmanol. See Bakelite Corp.
Rexlite. See Northern Industrial Chemical Co.
Reynolds Spring Co., Jackson, Mich.
Reynoldite. See Reynolds Spring Co.
Reynomold. See Reynolds Spring Co.
Richardson Co., Lockland, Cincinnati, O.
Ridgelite. See Ridgley Trimmer Co.
Ridgley Trimmer Co., Springfield, O.
Schneider Bros., Inc., 313 N. Sheldon Ave., Chicago.
Scranton Button Co., Scranton, Pa.
Shaw Insulator Co., Irvington, Newark, N. J.
Siemon Co., State and Dewey, Bridgeport, Conn.
Specialty Insulation Mfg. Co., Hoosick Falls, N. Y.
Star Insulate. See Insulation Mfg. Co.
Starite. See Insulation Mfg. Co.
Stokes & Smith Co., Summerdale Ave. near Roosevelt Blvd., Philadelphia, Pa.
Textolite. See General Elec. Co.
Thermoplax. See Cutler-Hammer Mfg. Co.
Tegit. See Garfield Mfg. Co.
Union Insulating Co., Parkersburg, W. Va.
Vulcabeston. See Colt's Patent Fire Arms Mfg. Co.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N. Y.
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Watertown Mfg. Co., Watertown, Conn.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

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Lohfeld & Co., J. L., 53 Park Place., New York, N. Y.
Palatine Industrial Co., 111 Fifth Ave., New York, N. Y.
Radiotherma, Inc., 45 E. 17th, New York, N. Y.
Sirian Wire Co., 255 Sherman Ave., Newark, N. J.

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MOTOR PLATFORM BASES. See Bases, Motor Platform
MOTOR STARTERS. See Controllers, Motor; Switches, Remote Control; Switches, Motor Starting; Safety; Switches Snap (Heavy Duty).

MOTORS

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Direct Current	See S
Motors, 1 Hp. up	See M
Motors Fractional Hp.	See F
Universal	See U

Actodector. See Roth Bros. & Co.
Advance Elec. Co., 4311 Maple Ave., St. Louis M F S
Allis-Chalmers Mfg. Co., Milwaukee, Wis..... M S
Allis Co., Louis, Milwaukee, Wis..... M S
American Elec. Motor Co., Cedarburg, Wis..... M
Apex Elec'l Mfg. Co., 1067 E. 152nd, Cleveland .. F S U
Armor Elec. Mfg. Co., 1020 Holland, Erie, Pa. M
Baldor Elec. Co., 4352 Duncan Ave., St. Louis M F S
B-Line. See Brown-Breckmeyer Co.
Bodine Elec. Co., 2254 Ohio, Chicago..... F S U
Bogue Elec. Co., Chas. J., 132 King, New York M
Brown-Breckmeyer Co., Norwood Power Bldg., Dayton, O..... M F
Burke Elec. Co., Erie, Pa..... M F S U
B. T. See Allis Co., Louis.
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Cleveland Armature Wks., 4732 St. Clair Ave., Cleveland, O..... M S
Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.
Crocker-Wheeler Elec. Mfg. Co., Ampere, N. J. M S U
Cushman Elec. Co., Concord N. H..... M F S
Day-Fan Electric Co., Dept. A, Dayton, O.... F S
Diehl Mfg. Co., Elizabeth, N. J..... M F S
Diverter Pole. See Rochester Elec. Product Co.
Domestic Electric Co., 7209 St. Clair Ave., Cleveland, O..... S
Dumore Co., 35 16th, Racine, Wis..... F U
Eclipse. See Fidelity Elec. Co.
Electric Machinery Co., Minneapolis, Minn.. M S
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O..... S
Electric Specialty Co., 221 South Stamford, Conn. M F S U
Electro-Dynamic Co., Bayonne, N. J..... M S
Emerson Electric Mfg. Co., 2014 Washington Ave., St. Louis, Mo..... M F S
Engberg's Elec. & Mechl. Works, St. Joseph, Mich..... M S
Esco. See Electric Specialty Co.
Fairbanks-Morse & Co., 900 S. Wabash Ave., Chicago, Ill..... M F
Fidelity Elec. Co., Lancaster, Pa..... M F S U
Fitzgerald Mfg. Co., Torrington, Conn..... F
Fynn Welchsel. See Wagner Elec. Corp.
Galvin Elec. Mfg. Co., 3314 S. Broadway, St. Louis, Mo..... F S
General Elec. Co., Schenectady, N. Y..... M F S U
Gilbert Co., A. C., New Haven, Conn..... F U
Hamilton Beach Mfg. Co., Racine, Wis..... F S U
Hobart Bros. Co., Troy, O..... M S
Holtzer-Cabot Elec. Co., 125 Amory, Boston... M F S
Howell Elec. Motors Co., Howell, Mich..... M S
Ideal Elec. & Mfg. Co., Mansfield, O..... M S
Imperial Electric Co., Akron, O..... M S
Janette Mfg. Co., 556 W. Monroe, Chicago..... F S
Jantz & Leist Elec. Co., Cincinnati, O..... M F
Jeannin Electric Co., Fassett & N. Y. C. R. R. Toledo, O..... M F S
Kendrick & Davis Co., Lebanon N. H..... F S
Kimble Elec. Co., 634 N. Western Ave., Chicago M S U
Knapp Elec., Inc., 350 Madison Ave., New York, N. Y..... F S U
Leland Elec. Co., Dayton, O..... F S
L. E. See Leland Elec. Co.
Lincoln Elec. Co., Cleveland, Ohio..... M S
Line-Weld. See Lincoln Elec. Co.
Linzee Elec. Motor Co., Mansfield, O..... M
Mando Co., Syracuse, N. Y..... F
Marathon Elec. Mfg. Co., 32 Island, Wausau, Wis. F
Marble-Card Elec. Co., Gladstone, Mich..... M
Master Electric Co., Dayton, O..... M F S
MC. See General Electric Co.
Michigan Elec. & Mfg. Co., Lake Linden, Mich. F S
N. C. See Electric Controller & Mfg. Co.
Norfolk. See Walter Elec. Mfg. Co.
North East Elec. Co., Rochester, N. Y..... F U
Northwestern Mfg. Co., 480 Clinton, Milwaukee M
Ohio Elec. & Controller Co., 5905 Maurice Ave., Cleveland, Ohio..... F S
O. K. See Marathon Elec. Mfg. Co.
Osann Co., F., 245 Seventh Ave., New York M
Peerless Elec. Co., 740 W. Market St., Warren, O. M F S U
Polar Cub. See Gilbert Co., A. C.
Pow-R-Full. See Wagner Elec. Corp.
Reco. See Reynolds Electric Co.
Red Band. See Howell Elec. Motors Co.
Reliance Elec. & Engrg. Co., 1042 Ivanhoe Rd., Cleveland, O..... M S
Reynolds Electric Co., 2650 W. Congress, Chicago .. F S
Robbins & Myers, Inc., Springfield, O..... M F S U
Roth Bros. & Co., Chicago, Ill..... M S
Standard. See Robbins & Myers Co.
Star Elec. Motor Co., Miller St. & N. J. R. R. Ave., Newark, N. J..... M S
Sterling Elec. Motors, Inc., Telegraph Rd. and Atlantic Blvd., Los Angeles, Cal..... M S
Stow Mfg. Co., Binghamton, N. Y..... M F S U
Sturtevant Co., 15 Devonshire (Hyde Park), Boston, Mass..... M F S U
Sunlight Electrical Mfg. Co., Warren, O..... F S
Super Wick. See Master Elec. Co.
Switch start. See Lincoln Elec. Co.
Triumph Elec. Corp., Carthage, O..... M S
Union Elec. Motor Mfg. Co., Hancock & Oxford Sts., Philadelphia, Pa..... M F S
U. S. Elec. Mfg. Co., 200 E. Slawson Ave., Los Angeles..... M S
Valley Elec. Co., 4321 Forest Park Blvd., St. Louis, Mo..... M S
Wagner Elec. Corp., 6400 Plymouth Ave., St. Louis, Mo..... M F S U
Walter Elec. Mfg. Co., Norfolk, Va..... M S
Watson. See Allis Co., Louis.
Welco Uniframe. See Wesche Elec. Co., B. A.
Wesche Elec. Co., B. A., 1622 Vine, Cincinnati M F S
Westinghouse Elec. Mfg. Co., East Pittsburgh M F S
Willey-Wray Elec. Co., Cincinnati, O..... M S
Woods Mach. Co., S. A., Boston..... M F S
Zobell Elec. Motor Co., Garwood, N. J..... M S

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Celoron Co. Div. of Continental-Diamond Fibre Co., Bridgeport, Pa.
Chandler Co., Springfield, Mass.
Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill
Electro-Chemical Engraving Co., 32 Vanderbilt Ave., New York, N. Y.
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Waterbury Button Co., Waterbury, Conn.

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American Mond Nickel Co., Century Bldg., Pittsburgh, Pa.
Driver-Harris Co., Harrison, N. J.
International Nickel Co., 67 Wall, New York, N. Y.
Seymour Mfg. Co., Seymour, Conn.
United States Nickel Co., New Brunswick, N. J.

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Ferracute Machine Co., Bridgeton, N. J.

NUT SETTING MACHINES

Vim Electric Tool Co., 149 Broadway, New York, N. Y.

OHMMETERS. See Istruments, Laboratory Standard; also Instruments, Portable and Switchboard.
OIL-LESS BEARINGS. See Bearings, Oil-less.
OSCILLOSCOPES. See Instruments, Laboratory Standard.

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Hayes, C. I., 129 Baker, Providence, R. I.
Heidbrink Co., 2633 Fourth Ave., S., Minneapolis, Minn.
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Stokes Machine Co., F. J., 5926 Tabor Rd. (Olney), Philadelphia.
Swartwout Co., 18522 Euclid Ave., Cleveland, O.
Thelco. See Freas Thermo Elec. Co.
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Young Bros. Co., 6523 Mack Ave., Detroit, Mich.

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Federal Metallic Packing Co., Wakefield, Mass.
Holed-Tite Packing, Inc., 100 E. 42nd, New York, N. Y.
Packtite. See Federal Metallic Packing Co.

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Varnishes, Insulating .....See V
Painting, Dipping, Spraying, Vacuum Impregnating.
Paint, Insulating and Acid Proof..See P
Lacquer, Metal Finishing .....See L

Acme White Lead & Color Wks., 3259 St. Aubin Ave., Detroit, Mich..... L
Ajax. See Sherwin-Williams Co.
Alaka. See Lacquer & Chemical Corp.
American Di-Electrics, Ltd., Hancock and Bodine, Long Island City, N. Y..... V
American Lastite Co., 3166 Lincoln Ave., Chicago.... P L
Antakwa Co., 1329 Mohawk, Chicago, Ill..... P
Arizona Lacquer Mfg. Co., 7 16th, Brooklyn, N. Y.... L
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Art-Craft. See Southwestern Paint & Varnish Co.
Atlantic Chemical Co., Coit, Irvington, N. J..... L
Atom Chemical Co., 96 E. 10th, New York, N. Y..... L
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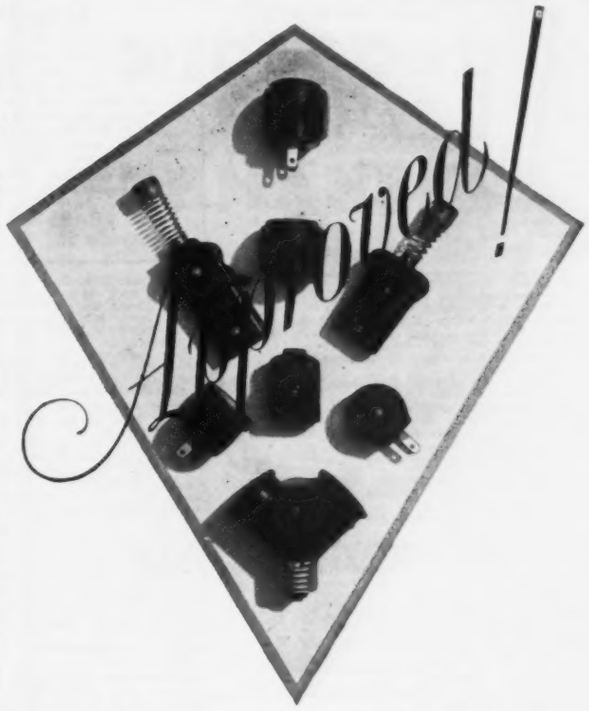

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Duco. See Du Pont de Nemours & Co.
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Eastman Kodak Co., Rochester, N. Y. L
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Kodalak. See Eastman Kodak Co.
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Bushings. See Tubes, Paper.
Candles. See Candles, Fixture.
Cores. See Tubes, Paper.
Fibre. See Cloth and Paper.
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PLUGS. Attachment—Continued
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Utilo Mfg. Co., 320 E. Liberty, Lancaster, Pa.
Weber. See Sears, Henry D.
Wellmade Elec. Mfg. Co., Torrington, Conn.
Wilshire. See Iona Co.
Yankee. See Beaver Mfg. Co.
POCKET METERS. See Instruments, Pocket.

POINTS, Contact

American Platinum Wks., 241 New Jersey Railroad Ave., Newark, N. J.
Baker & Co., Inc., 54 Austin, Newark, N. J. (Gold, Platinum, Silver.)
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J. (Platinum and Silver.)
Cohn, Sigmund, 44 Gold, New York, N. Y. (Platinum.)
Elkon, Inc. (Div. of P. R. Mallory Co.), 350 Madison Ave., New York, N. Y.
Fansteel Products Co., North Chicago, Ill.
Hardy Metal Corp., Seattle, Wash.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Independent Contact Mfg. Co., 545 39th, Union City, N. J. (Tungsten.)
Interstate Products Corp., 29 Commercial, Newark, N. J. (Platinum and Silver.)
King Mfg. Corp., Kano & Crowley Sts., Buffalo, N. Y. (Platinum.)
National Contact Co., 33 W. 60th, New York. (Platinum.)
Niehoff & Co., C. E., 230 W. Superior, Chicago. (Platinum.)
R. & H. Platinum Works, 709 Sixth Ave., New York.
Spark-O-Metal. See Hardy Metal Corp.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J. (Platinum and Silver.)
POLARITY INDICATORS. See Instruments, Pocket.
POLISHING MACHINES, WIRE. See Wire Polishing Machines.

PORCELAIN

Bushings. See Bushings, Box & Cabinet.
Liquid. See Cement, Liquid Porcelain.
Molding Machine. See Presses, Porcelain Molding.
Reflectors (Enameled). See Reflectors, Porcelain Enameled.
Refractory. See Cores, Resistance Coil.

PORCELAIN, Special Shapes

Akron Porcelain Co., Akron, Ohio.
American Porcelain Co., E. Liverpool, O.
A. P. See Akron Porcelain Co.
Burgess & Co., East Liverpool, O.
Central Porcelain Co., Columbiana, O.
Circle F Mfg. Co., Trenton, N. J.
Colonial Insulator Co., Akron, O.
Connecticut Porcelain Co., Trenton, N. J.
Cook Pottery Co., Trenton, N. J.
Corns China Co., Wellsville, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Globe Porcelain Co., Mulberry St. and St. Joes Ave., Trenton, N. J.
Hartford Faience Co., Hartford, Conn.
Hub-Way Mfg. Co., Hubbard, Ohio.
Illinois Electric Porcelain Co., Macomb, Ill.
Imperial Porcelain Wks., Canal and Mulberry, Trenton, N. J.
Knox Porcelain Corp., Knoxville, Tenn.
Louthan Mfg. Co., East Liverpool, O.
Mercer Porcelain Co., Trenton, N. J.
Metech Refractories Co., East Liverpool, Ohio.
National Porcelain Co., Trenton, N. J.
New Jersey Porcelain Co., Trenton, N. J.
Nu Blue. See Star Porcelain Co.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
Porcelava. See Burgess & Co.
Porcelain Products, Inc., Findlay, Ohio.
Square D Company, Detroit, Mich.
Standard & Specialty Porcelain Co., Sun Prairie, Wis.
Star Porcelain Co., Muirhead St., Trenton, N. J.
Thomas & Sons Co., R., Lisbon, O.
Trenle Porcelain Co., East Liverpool, Ohio.
Union Elec'l Porcelain Wks., Inc., Trenton, N. J.
Washington Porcelain Co., Washington, N. J.
Woolley, Inc., W. Douglas, East Liverpool, O.

POROUS CUPS

Unglazed earthenware cups for primary (wet) batteries
Colonial Insulator Co., Akron, Ohio.
Maddocks Sons, John, Trenton, N. J.
Ohio Pottery Co., Zanesville, Ohio.
Robinson Clay Products Co., Akron, Ohio.

POSTS, Binding

Binding Posts, Switch Parts, Stop Points, Contacts, Arms, Levers. See also Radio Mountings.
American Radio Hardware Co., 135 Grand, New York
Bunnell & Co., J. H., 32 Park Pl., New York, N. Y.
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
DeJur-Amsco Corp., 418 Broome, New York, N. Y.
Eby Mfg. Co., Inc., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Ensign. See Eby Mfg. Co., H. H.
Eureka. See Frank W. Morse Co.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Gray Bros., Plano, Ill.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
King. See Morse Co., Frank W.
Morse Co., Frank W., 289 Congress, Boston. (Spring Grip Nutmeg. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Polk, J. L., 41 Bell Ave., Troy, N. Y.
Premier Elec. Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Quality. See H. H. Eby Mfg. Co.
Queen. See Morse Co., Frank W.
Thomaston Mfg. Co., Thomaston, Conn.
Waterbury Button Co., Waterbury, Conn.
POTENTIDMETERS (Instruments). See Instruments, Laboratory Standard.
POTENTIOMETERS (Radio Control). See Radio Receiver Parts.
POWDERED CARBON. See Carbon, Powdered.
POWER TRANSMISSION CHAIN. See Chain, Power Transmission.
PRESS BOARD. See Cloth and Paper.

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PRESSES, Armature Coil

Comstock Mfg. Co., Wilkes-Barre, Pa.
PRESSES, ARMATURE NOTCHING. See Notching Machines, Armature.

PRESSES, Molded Insulation

Burroughs Co., 246 N. Tenth, Newark, N. J.
Dunning & Boschert Press Co., 329 W. Water, Syracuse
Elmes Engrg. Works, Chas. F., 223 N. Morgan, Chicago, Ill
Evans Engrg. Works, Chas. E., 1003 Fulton, Chicago, Ill
Farquhar Co., A. B., York, Pa.
Southwark Fdy. & Mach. Co., 400 Washington Ave., Philadelphia, Pa.
Stokes Mach. Co., F. J., 5926 Tabor Rd., Olney, Philadelphia, Pa.
Terkelson Machine Co., 326 A, Boston, Mass.
Watson-Stillman Co., 75 West St., New York, N. Y
Wood & Co., R. D., Florence, N. J.

PRESSES, Porcelain Molding

Baird, Andrew, 2715 Newark, Detroit, Mich.

PRESSES, Punching

Bench Presses—Power Presses; for Punching & Stamping Sheet Metal.
Ams Machine Co., Max, 101 Park Ave., New York, N. Y
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., 53rd St. & Second Ave., Brooklyn, N. Y
Dunning & Boschert Press Co., 329 W. Water, Syracuse
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hyro Mfg. Co., 200 Varick, New York, N. Y.
Lombough-Jordan Tool & Machine Co., Elkhart, Ind.
Peck, Stow & Wilcox Co., Southington, Conn.

PRISMS, Chandelier. See Crystals, Chandelier.

PROJECTOR LENSES. See Lenses.

PULLERS, Armature Shaft

Motor Pulley, Shaft & Pinion Pullers & Extractors
Allen Electric & Equipment Co., Kalamazoo, Mich.
Big Buster. See Premier Elec. Co.
Crane Puller Co., Waltham, Mass.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Company, Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Little Giant. See Premier Elec. Co.
Peerless. See Electric Service Supplies Co.
Premier Electric Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Weidenhoff, Joseph, 4353 Roosevelt Rd., Chicago, Ill.

PULLEYS, Composition

General Electric Co., Schenectady, N. Y.
Rockwood Mfg. Co., Indianapolis, Ind.
Sprucolite Co., Bloomfield, N. J.

PUMPS, Oil Burner

Janette Mfg. Co., 556 W. Monroe, Chicago, Ill.
Milwaukee Tank Wks., Milwaukee, Wis.
Monroe Machine Tool Co., 737 W. Jackson Blvd., Chicago
Reflex. See Simplex Oil Heating Co.
Simplex Oil Heating Co., 1199 Eddy, Providence, R. I.
Teesdale Mfg. Co., 427 Market, Grand Rapids, Mich.
Zisch Engineering Co., 39 Ave. L, Newark, N. J.

PUMPS, Vacuum

To Exhaust Incandescent Lamps.
Arrow Machine Co., 527 Hackensack Plank Rd., Union City, N. J.
Beach-Russ Co., 50 Church, New York, N. Y.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Dunham Co., C. A., 450 East Ohio, Chicago, Ill.
Elmer & Amend, 205 3rd Ave., New York, N. Y.
Eisler Engineering Co., 770 S. 13th, Newark, N. J.
General Electric Co., Schenectady, N. Y.
Hubbard's Sons, Norman, 1 Carlton Ave., Brooklyn, N. Y.
Leiman Bros., 23 Walker, New York, N. Y.
Packard. See Hubbard's Sons, Norman.

PUNCHING PRESSES. See Presses, Punching.

PUNCHING and BENDING, Sheet Steel

Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

RACKS, Wire Reel

(With Tension Device Attached).
Armature Coil Equipment Co., 3415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Elec'l Wks., P. E., 1820 Chouteau Ave., St. Louis, Mo. (Tensionless Dereeler)
Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Elec. Co., Schenectady, N. Y. (Tension Indicator.)
Mutual Foundry & Machine Co., Atlanta, Georgia.
Segur. See Electric Service Supplies Co.

RADIO CIRCUIT COMPONENTS

This heading includes Inductances (Coils), Capacitors (Condensers), Fixed Resistances, Grid Leaks, Transformers, Choke Coils, and Filters, also Amplifier Units and Kits.
Acme Appar. Corp., 39 Osborne, Cambridge, Mass.
Acme Products Co., Boston, Mass.
Acme Wire Co., New Haven, Conn.
Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Aero Products, Inc., 1772 Wilson Ave., Chicago, Ill.
Air-King Products Co., 216 Wallabout, Brooklyn, N. Y.
Ajax Elec. Specialty Co., St. Louis, Mo.
Alden Mfg. Co., Springfield, Mass.
All-American Mohawk Corp., 4201 Belmont Ave., Chicago.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Amerchoke. See American Transformer Co.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
American Transformer Co., Newark, N. J
Amperite Rheostat. See Radiall Co.
Arco Elec'l Corp., 211 E. Columbia, Fort Wayne, Ind.
Arctic. See Premier Elec. Co.
Audioformer Transformer. See Pacent Electric Co.
Autoformer. See Thordarson Elec. Mfg. Co.
Automotive Parts Mfg. Co., 70 Washington St., Brooklyn, N. Y.
B-Conomizer. See Pilot Elec. Mfg. Co.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Bonine. See Turn-it Radio Sales.
Branston Co., Chas. A., 297 Washington, Buffalo, N. Y.
Bremer-Tully Mfg. Co., 520 S. Canal, Chicago, Ill.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn, N. Y.
Browning-Drake Corp., 110 Brookline, Cambridge, Mass.
Buffer. See Aerovox Wireless Corp.
Buffalo. See De Jur-Amsco Corp.
Camfield. See Columbia Metal Products Co.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Capacigrad. See Pilot Elec. Mfg. Co.
Cardwell Mfg. Corp., Allen D., 81 Prospect, Brooklyn, N. Y.
Carter Mfg. Co., 6300 Euclid Blvd., East Cleveland, O.
Central Radio Corp., Beloit, Wis.
Centraline. See Pilot Elec. Mfg. Co.
Certified Condenser. See Radio Condenser Co.
Chelten Elec. Co., 4859 Stenton Ave., Philadelphia, Pa.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago,

Clarostat Mfg. Co., 281 N. Sixth, Brooklyn, N. Y. (Radio Resistance.)
Cole Radio Mfg. Corp., 536 Bloomfield Ave., Bloomfield, N. J.
Columbia Metal Products Co., 360 E. Grand Ave., Chicago,
Contertone. See Chicago-Jefferson Fuse.
Connectoralds. See Alden Mfg. Co.
Continental Carbon, Inc., Cleveland, O.
Continental. See Gardiner & Hepburn, Inc.
Counterphase Kit. See Bremer-Tully Mfg. Co.
Crescadio Corp., 166-32 Jamaica Ave., Jamaica, N. Y.
Crefco. See Premier Elec. Co.
Daven Corp., 158 Summit, Newark, N. J. (Kits)
DeForest Radio Co., Jersey City, N. J.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Diamond Weave Coil. See Sickles Co., F. W.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Dubilier Condenser Corp., 4377 Bronx Blvd., New York.
Dumont Elec. Co., 40 W. 17th, New York, N. Y.
Duratran. See Dubilier Condenser Corp.
Durham & Co., 1936 Market, Philadelphia, Pa.
Dymac. See Electrical Products Mfg. Co.
Dynohmic. See Lynch, Inc.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I. (Kit.)
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill.
Electro Motive Engineering Corp., 127 W. 17th, New York.
Elkay. See Langbein Kaufman Radio Co.
Elkon, Inc., 350 Madison Ave., New York, N. Y.
El Menco. See Electro Motive Engineering Co.
Equamatic Kit. See Karas Elec. Co.
Equitrol. See Cardwell Mfg. Corp.
Euphonic. See Bremer-Tully Mfg. Co.
Excelsior Radio Corp., 216 Wallabout, Brooklyn, N. Y.
E-Z. See Polymet Mfg. Corp.
Faradon. See Wireless Specialty Apparatus Co.
Fast Co., John E., Crawford & Barry Ave., Chicago, Ill.
Ferranti, Inc., 130 W. 42nd, New York, N. Y.
Filatrol. See De Jur-Amsco Corp.
Filtrola. See All-American Mohawk Corp.
Flechtheim Co., A. M., 136 Liberty, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind.
F. & H. Radio Laboratories, Fargo, N. D.
Gardiner & Hepburn, Inc., 611 Widener Bldg., Philadelphia, Pa.
General Instrument Corp., 225 Varick, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
General Transformer Corp., 900 W. Jackson Blvd., Chicago.
General Winding Co., 214 Fulton, New York, N. Y.
Gen-Win. See General Winding Co.
Glastor. See Daven Corp.
Glotar Corp., Niagara Falls, N. Y.
Glo-Dial. See Wireless Radio Corp.
Gray & Danielson Mfg. Co., 260 1st, San Francisco, Cal.
Halldorsen Co., 4745 N. Western Ave., Chicago, Ill.
Hammarlund Mfg. Co., 424 W. 33rd, New York, N. Y.
Hardwick, Hindle, Inc., 122 Greenwich, New York, N. Y.
Harmonik. See Karas Elec. Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. (TRF Kits.)
Heath & Co., Geo. W., 260 First Ave., Newark, N. J.
Hedgehog Transformer. See Premier Elec. Co.
Heinemann Elec. Co., Philadelphia, Pa.
Hi-Q Kit. See Hammarlund.
Hum-Dinger. See Clarostat Mfg. Co.
Hy-Wat. See Electro Motive Engineering Corp.
Igrad Condenser & Mfg. Co., 26 Avenue D, Rochester, N. Y.
Infra-Dyne. See Gray & Danielson Co.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa.
Isograd, Isoleak. See Pilot Elec. Mfg. Co.
J-M-P. Mfg. Co., 3329 Fond du Lac Ave., Milwaukee, Wis.
Karas Elec. Co., 4046 N. Rockwell, Chicago, Ill.
Kelford. See American Specialty Co.
Kenyon Transformer Co., 122 Cypress Ave., New York, N. Y.
Kilograd. See Pilot Elec. Mfg. Co.
Kroblack. See Mountford, C. E.
Kuprox. See Kodel Radio Corp.
Langbein-Kaufman Radio Co., 62 Franklin, New Haven, Conn.
Lavite. See Aerovox Wireles Corp.
Lautz Mfg. Co., 245 N. J. R. R. Ave., Newark, N. J. (Radio Resistance).
Lekeless. See Benjamin Elec. Mfg. Co.
Lempis. See General Winding Co.
L. M. C. See Lautz Mfg. Co.
Loftin-White. See Hammarlund Mfg. Co.
Loless. See Wireless Radio Corp.
Lynch, Arthur H., 1775 Broadway, New York, N. Y.
Marco. See Martin-Copeland Co.
Martin-Copeland Co., 191 Sabin, Providence, R. I.
Maxitran. See Electrical Research Laboratories.
Mayolian Corp., 1668 Webster Ave., New York, N. Y. (Tone Filter.)
Meggit. See Cole Mfg. Corp.
Melco-Supreme. See De Jur-Amsco Corp.
Melcoupler. See Robertson-Davis Co.
Meloformer. See Robertson-Davis Co.
Metaleak. See Dubilier Condenser Corp.
Metralign. See General Instrument Corp.
Micadon Condenser. See Dubilier Condenser Corp.
Micamold Radio Corp., 1087 Flushing Ave., Brooklyn, N. Y. (Amplifier Kit.)
Mica-Static. See Dubilier Condenser Corp.
Micon Condenser. See Dubilier Condenser Corp.
Microcondenser. See Sterling Mfg. Co.
Microgrid. See Pilot Elec. Mfg. Co.
Micrometric. See Karas Elec. Co.
Microstat. See Premier Elec. Co.
Midline. See Hammarlund Mfg. Co.
Modern Electric Mfg. Co., Toledo, O.
Mountford, C. E., 30 Sullivan, New York, N. Y.
Muter Co., Leslie F., 76th St. and Greenwood Ave., Chicago, Ill. (Amplifier Kits.)
National Co., 61 Sherman St., Malden, Mass.
Neutre-Grad. See Pilot Elec. Mfg. Co.
New York Coil Co., Mount Clare, Pa.
Nutmeg. See Hart & Hegeman Mfg. Co.
Ohio Carbon Co., 3215 Almira Ave., Cleveland, O.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill. (Resistance.)
Orthometric. See Karas Elec. Co.
Orthophone. See De Jur-Amsco Corp.
Pacent Electric Co., 91 7th Ave., New York, N. Y.
Pam. See Samson Elec. Co.
Panatrol See Wireless Radio Corp.
Perry Elec'l Resistor Corp., 280 New Main St., Yonkers, N. Y.

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Philmore Mfg. Co., 106 7th Ave., New York, N. Y.
Plander. See De Jur-Amsco Corp.
Pierce Airo. See United Scientific Laboratories.
Pilot Elec. Mfg. Co., 323 Berry, Brooklyn, N. Y.
Pilotran. See Pilot Elec. Mfg. Co.
Potter Mfg. Co., North Chicago, Ill.
Polymet Mfg. Corp., 599 Broadway, New York, N. Y.
Power Box. See Scott Sales Co.
Powerohm. See International Resistance Co.
Powrad, Inc., 486 Johnson Ave., Brooklyn, N. Y.
Precision Coil Co., 122 Greenwich, New York, N. Y.
Precise Mfg. Corp., 254 Mill, Rochester, N. Y.
Premier Elec Co., Dept. 1323, 3800 Ravenswood Ave. Chicago, Ill.
Protectoraid. See Alden Mfg. Co.
Pyrohm. See Aerovox Wireless Corp.
Radiall Co., 50 Franklin, New York, N. Y.
Radio Appliance Corp., Springfield, Mass.
Radio Condenser Co., Thorn & Copewood, Camden, N. J.
Radio Engrg. Laboratories, 100 Wilbur Ave., Long Island City, N. Y. (Short Wave Kit.)
Radiolec Switch. See Cutler-Hammer Mfg. Co.
Radio Receptor Co., 106 7th Ave., New York.
Radiostat. See Allen-Bradley Co.
Raola. See Modern Elec. Mfg. Co.
Rauland-Lyric. See All American Mohawk Corp.
Receptrad. See Radio Receptor Co.
Reesonator. See F. & H. Radio Laboratories.
Regal. See American Specialty Mfg. Co.
Reliable Parts Mfg. Co., Wellington, O.
Remler. See Gray & Danielson Co.
Resistaformer. See Aerovox Wireless Corp.
Resistograd. See Pilot Elec. Mfg. Co.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent), Hatheway & Co., 16 Hudson, New York, N. Y.
Roberts Condenser. See Hammarlund Mfg. Co.
Robertson-Davis Co., 412 Orleans, Chicago, Ill.
Samson Elec. Co., Canton, Mass. (TRF Kits.)
Sangamo Elec. Companies, Springfield, Ill.
Scanlan Elec. Mfg. Co., 1113 N. Franklin, Chicago, Ill (Output Transformers.)
Scovill Mfg. Co., Waterbury, Conn.
Senior. See All American Mohawk Corp.
Sensory. See Heinemann Electric Co.
Sevison Magneto Engr. Co., 397 Phillips, Toledo, O.
Sickles Co., F. W., 130 Union, Springfield, Mass.
Signal Elec. Mfg. Co., Menominee, Mich.
Silver-Marshall, Inc., 846 W. Jackson Blvd., Chicago. (Amplifier Kits.)
Silvertone. See Radio Receptor Co.
S. L. S. See Wireless Radio Corp.
S. L. T. See General Instrument Corp.
Somersolo. See DeForest Radio Co.
Splitmeter. See Premier Electric Co.
Sprague Specialties Co., Dept. M., Quincy, Mass.
Standard Transformer Co., Warren, O.
Sta-Put. See Martin-Copeland Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, O.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave Rochester, N. Y.
Submariner. See J-M-P Mfg. Co.
Super Multiformer. See Precise Mfg. Corp.
Supertran Transformer. See Ford Radio & Mica Co.
Symphony. See Modern Elec. Mfg. Co.
Syncrodenser. See Precise Mfg. Corp.
Tandem. See Bremer-Tully Mfg. Co.
Telemonic Coil. See Condenser Corp. of America.
Telos Coil. See Condenser Corp. of America.
Thompson-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thordarson Elec. Mfg. Co., Huron & Kingsbury Sts., Chicago
Tobe Deutschman Co., Canton, Mass.
Tone Control. See Sprague Specialties Co.
Toroid. See All American Mohawk Corp.
Torostyle. See Bremer-Tully Mfg. Co.
Transcript-Clapp Kit. See Samson Electric Co.
Truphonic Amplification. See Alden Mfg. Co.
Tunadapta. See Lynch, Arthur H.
Twin-aud. See Peerless Radio Co.
Twin-Eight Transformers. See Bodine Electric Co.
Two-Ten & Two-Eleven. See Silver-Marshall.
Tyrman Elec. Corp. 143 W. Austin Ave., Chicago, Ill
Ultra Vario. See Bruno Radio Corp.
Univernier Condenser. See Auburn Button Works.
Universal Electro Chemical Corp., 30 W. 15th, New York
Universal Winding Co., Boston, Mass.
Variall Condenser. See Muter Co.
Volta. See Universal Electro Chemical Corp.
Waterbury Button Co. Waterbury, Conn.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn N. Y.
Wireless Specialty Apparatus Co. (J. P.), Boston, Mass
RADIO HARDWARE. See Radio Mountings.

RADIO MOUNTINGS

Coil Mountings, Coil Sliders and Rods, Switches, Detectors Detector and Grid Leak Mountings, Panel Brackets, Special Radio Hardware & Trimmings, Metal Dials, Metal Panels etc.

Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y
Alden Mfg. Co., Brockton, Mass.
American Radio Hardware Co., 135 Grand, New York
Bonza. See Haydon & Haydon.
Carborundum Co., Niagara Falls, N. Y. (Detector.)
Chapman Machine Co., Terryville, Conn.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Durham & Co., 1936 Market, Philadelphia, Pa.
Electrad, Inc., 175 Varick, New York, N. Y.
Etched Products Corp., 90 Tenth, Long Island City, N. Y (Metal Panels.)
Eureka. See Morse Co Frank W.
General Etching & Mfg. Co., 3072 West Grand Ave., Chicago, Ill (Metal Panels & Escutcheons.)
Globe Technolian Corp., Reading, Mass.
Glodial. See Wireless Radio Corp.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Haydon & Haydon, 167 Chambers, New York, N. Y.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 76th and Greenwood Ave., Chicago.
Na-Ald. See Alden Mfg. Co.
Union Insulating Co., 296 Broadway, New York, N. Y.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn.
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.
RADIO PANEL ENGRAVING. See Engraving, Radio Panel.

RADIO RECEIVER PARTS

Rheostats, Sockets, Plugs, Jacks.

Acme Elec. & Mfg. Co., 1652 Rockwell, Cleveland, Ohio.
Alden Mfg. Co., Springfield, Mass.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport Conn.
Automotive Equipment Co., 317 Halsey, Newark, N. J.
B. M. S. See Brooklyn Metal Stamping Corp.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. (Multiple Plugs.)
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Brach Mfg. Corp., L. S., 120 Sussex Ave., Newark, N. J
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn
Cabelug. See Jones, Howard B.
Carter Radio Co., 300 S. Racine Ave., Chicago, Ill. (Also Socket Adapters.)

Central Radio Laboratories, 14 Keefe Ave., Milwaukee.
Centralab. See Central Radio Laboratories.
Clarostat Mfg. Co., 285 N. 81xth, Brooklyn, N. Y.
Cle-Ra-Tone. See Benjamin Elec. Mfg. Co.
D. A. Radio Co., 30 Hollister, Buffalo, N. Y.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
De Veau. See Stanley & Patterson.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Duostat. See De Jur-Amsco Corp.
E-Z. See Polymet Mfg. Corp.
Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa
Electrad, Inc., 175 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I.
Fantail Plug. See Brooklyn Metal Stamping Corp.
Frost, Herbert H., 1142 W. Beardsley, Elkhart, Ind.
Gem-Jac. See Frost, Herbert H.
General Instrument Corp., 225 Varick, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
Gray & Danielson Mfg. Co., 260 First, San Francisco, Cal.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Heinemann Elec. Co., Philadelphia, Pa.
Imp. See Carter Radio Co.
Jones, Howard B., 2226 Wabansia, Chicago, (Multiple Plug.)
Klosner Radio Corp., 1022 E. 178th, New York, N. Y.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Modu-Plug. See Central Radio Lab.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 76th & Greenwood Ave., Chicago.
Nutmeg. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Parent Elec. Co., 91 Seventh Ave., New York, N. Y.
Pan-Tab Jack. See Frost, Herbert H.
Philmore Mfg. Co., 106 Seventh Ave., New York, N. Y.
Pilot Elec. Mfg. Co., 323 Berry, Brooklyn, N. Y.
Polymet Mfg. Corp., 599 Broadway, New York, N. Y.
Premier Elec. Co., Dept. 1323, 3800 Ravenswood Ave. Chicago, Ill.
Recto Mfg. Co., 23 W. Third, Cincinnati, Ohio
Robertson-Davis Co., 361 W. Superior, Chicago, Ill.
Royalty. See Electrad, Inc.
Samson Elec. Co., Canton, Mass.
Socostat. See D. A. Radio Co.
Stanley & Patterson, 150 Varick, New York, N. Y.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio
Tubestat. See Muter Co.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

RADIO RECTIFIER TUBES

Armstrong Elec. & Mfg. Co., 351 Halsey, Newark, N. J
Cable Supply Co., 80 Union Square, New York, N. Y.
Ceco Mfg. Co., 702 Eddy, Providence, R. I.
Conaway Elec. Laboratories, 406 Jefferson, Hoboken, N. J
Cunningham, Inc., E. T., 370 Seventh Ave., New York, N. Y
DeForest Radio Co., Franklin St. & Central Ave., Jersey City, N. J.
Diamond Vacuum Products Co., 4053 Diversey Ave., Chicago
Gold Seal Electrical Co. of Ohio, Inc., 250 Park Ave., New York, N. Y.
La Salle Radio Corp., Div. of Matchless Elec. Co., 145 W. Austin Ave., Chicago, Ill.
Manhattan Elect. Supply Co., 190 Sixth Ave., New York.
Northern Mfg. Co., 367 Ogden, Newark, N. J.
Paramount Mfg. Co., 79 Orange, Newark, N. J.
Perryman Electric Co., 33 W. 60th, New York, N. Y
Radio Corp. of America, 233 Broadway, New York.
Raytheon Mfg. Co., Kendall Square Bldg., Cambridge, Mass
Revall Mfg. Co., 71 Euclid Bldg., Cleveland, O.
Sonatron Tube Co., 1020 S. Central Park Ave., Chicago, Ill
Specialty Appliance Co., 6611 Euclid Ave., Cleveland, Ohio
Sylvania Products Co., Emporium, Pa.
Televocal Corp., 588 Twelfth, West New York, N. J
United Radio & Elec. Corp., 500 Chancellor Ave., Irvington N. J.

RADIO TRANSFORMERS. See Radio Circuit Components.
RADIO TUBE BASE BRANDERS. See Engraving Radio Panel.
RADIO TUBE BASES. See Radio Molded Parts.
RADIO TUBE BULBS (Unfinished). See Bulbs, Glass

RADIO WIRING HARNESS

Special wiring cable and harness assemblies for radio battery connections, radio tube adapter harness for converting battery operated receivers to A.C. operation; Socket Adapters for Power Tubes; Loud Speaker Extension Cords—This heading also includes auto ignition assemblies.

Afco. See American Fabric Co.
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo.
Alden Mfg. Co., Brockton, Mass. (Adapters.)
Alpbus. See Alpha Radio Supply Co.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y
Alpstrand. See Alpha Radio Supply Co.
American Braiding Co., Holyoke, Mass.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Birnbach Radio Co., 254 W. 31st St., New York, N. Y
Blue Ribbon. See Crescent Braid Co.
Brach Mfg. Co., L. S., Newark, N. J.
Carter Radio Co., 300 S. Racine Ave., Chicago, Ill (Adapters.)
Connectoraids. See Alden Mfg. Co.
Cornish Wire Co., 30 Church, New York, N. Y.
Corwico. See Cornish Wire Co.
Crescent Braid Co., Providence, R. I.
Crescent Insulated Wire & Cable Co. Trenton, N. J
De Luxe, 50 W. Houston, New York, N. Y.
Diamond Braiding Mills, Chicago Heights, Ill.
Echo. See Cornish Wire Co.
Enterprise Mfg. Co., Third & Dauphin Sts., Philadelphia, Pa. (Adapters).
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind (Adapters.)
Hatfield Rubber Wks., Inc., Hillside, N. J.
Lusterized. See American Braiding Co.
Manhattan Insulated Wire Co., 17 W. 60th St., New York
Power, Inc., Harold J., Medford Hillside, Mass. (Adapters)
Radio Receptor Co., 106 Seventh Ave., New York, N. Y (Adapters.)
Rigs. See Birnbach Radio Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio. (Adapters).
Wilkens Mfg. Co., 52 Orawaupun St., White Plains, N. Y

RADIUM POWDER AND PAINT

Radium Dial Co., 3332 Forbes, Pittsburgh, Pa.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y.
RANGE SWITCHES, Rotary Snap. See Switches, Snap, Heavy Duty.
RAWHIDE GEARS. See Gears & Pinions, Rawhide.
READING LAMP BASES. See Bases, Reading Lamp.
REAMERS, Pipe. See Stocks, Dies and Reamers.
RECEPTACLES, Lamp. See Sockets and Receptacles

RECEPTACLES, Plug, Heavy Duty

KEY	
Battery Charging	See B
Floor Boxes	See F
Welding	See W
Machine Tool	See W
Watertight, Marine, Mine	See M
Car Trailer Connection	See C
Extension	See E

A. B. C. See Anderson Mfg. Co.
Adam Electric Co., Frank, St. Louis, Mo. F
Adapti Co., 2996 E. 72nd, Cleveland, O. F
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass. B W M C E
Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill. M
Arktite. See Crouse-Hinds Co.
Arnessen Electric Co., 13 Water, New York M
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn., F B W
Auth Electrical Specialty Co., 422 E. 53rd, New York, N. Y. E
Benjamin Elec. Mfg. Co., Des Plaines, Ill. F W M
Bryant Elec. Co., Bridgeport, Conn. (Also Range Type.) W
Campbell. See Steel City Elec. Co.
Cannon Elec. Development Co., 420 West Ave., 33, Los Angeles, Cal. F
C. E. M. Co. See Conn. Elec. Mfg. Co.
C. H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. M
Conduletto. See Crouse-Hinds Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn. F
Cory & Son, Chas., 183 Varick, New York M
Crouse-Hinds Co., Syracuse N. Y. B W
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis. F
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa. C
Elwell Parker Elec. Co., 4222 St. Clair Ave., N. E., Cleveland, O. B
Fielding. See Stanley & Patterson.
Fountain's. See Jenkins Mfg. Co.
Fullman Mfg. Co., Latrobe, Pa. F
Fullman. See Steel City Elec. Co.
General Elec. Co., Section W-234, Merchandise Dept., Bridgeport, Conn. B
Gleason & Co., J. L., 241 Franklin, Boston, Mass. E
H. & H. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. B W
Hessel Co., W. F., 76 Greenwich, New York, N. Y. W M E
Hubbell, Inc., Harvey, Bridgeport, Conn. (Also Range Type.) B W
Indestructible. See Kliegl Bros. Universal.
Jenkins Mfg. Co., Bloomfield, N. J. E
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y. F B W M
Latrobe. See Fullman Mfg. Co.
Loeffelholz & Co., Milwaukee, Wis. C
Major Equipment Co., 4603 Fullerton Ave., Chicago, Ill. M
Neco. See Novelty Elec. Co.
NePage McKenny Co., Armour Bldg., Seattle, Wash. F
Novelty Elec. Co., Tench & Cherry Sts., Philadelphia, Pa. C
Ohio Elec. & Controller Co., 5905 Maurice Ave., Cleveland, Ohio W
Ostrander Elecl. Works, W. R., 911 Atlantic Ave., Brooklyn, N. Y.
Prest-O-Lite. See Walker Bros. Co.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill. W M C E
Quadrangle Mfg. Co., 30 S. Peoria, Chicago, Ill. (Combination wall bracket and convenience outlet.)
Raleo Mfg. Co., 123 N. Albany Ave., Chicago, Ill.
Russell & Stoll Co., 53 Rose, New York F B W M E
Square D. Co., Detroit, Mich. W
Stanley & Patterson, 150 Varick, New York, N. Y. F
Steel City Elec. Co., Pittsburgh, Pa. F E
Thomas & Betts Co., 15 Park Place, New York, N. Y. F
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa. M
Walker Bros., 1417 Sansom, Philadelphia F E
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. F B W M
Yale. See Electric Products Co.
RECORDERS, Elapsed Time. See Indicators, Operation.
REDUCERS, Socket. See Socket Reducers.
REFLECTOR LENSES. See Lenses.

REFLECTORS, Porcelain Enameled, Steel

ABolite Reflector Co., 7560 Sherman Ave., Cleveland, O.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Cello, Inc., 96 Prince, New York, N. Y.
Dunlap Co., John, Carnegie, Pa.
Durex. See Wheeler Reflector Co.
Federal Electric Co., 8700 S. State, Chicago, Ill.
Goodlites. See Goodrich Elec. Co.
Goodrich Elec. Co., 1650 Ogden Ave., Chicago, Ill.
Isolux. See Wheeler Reflector Co.
Ivanhoe Division of Miller Co., Cleveland.
Marbelite Art Products Co., 140 N. Robey, Chicago, Ill.
Monk, H. E., 18 Warren, New York, N. Y.
Multi Elecl. Mfg. Co., 210 N. Ogden Ave., Chicago, Ill.
Oamed. See Overbaugh & Ayers.
Overbaugh & Ayers, 411 S. Clinton, Chicago, Ill.
Para Steel. See Wheeler Reflector Co.
Perfection. See Tindall & White.
Philadelphia Elec'l & Mfg. Co., 1228 N. 31st, Philadelphia.
Quad. See Quadrangle Mfg. Co.
Quadrangle Mfg. Co., 30 S. Peoria, Chicago Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Sturdox. See Benjamin Elec. Mfg. Co.
Tindall & White, 33 W. 60th, New York, N. Y.
Vaporlux. See Wheeler Reflector Co.
Westinghouse Elec. & Mfg. Co., South Bend, Ind.
Wheeler Reflector Co., 275 Congress, Boston, Mass.
REFRIGERANTS. See Chemicals, Refrigeration.
REFRIGERATION CHEMICALS. See Chemicals, Refrigeration.

REFRIGERATOR CABINETS

Airtite. See Rhinelander Refrigerator Co.
Alaska Refrigerator Co., Muskegon, Mich.
American Refrigerator Corp., Peru, Ind.
Arlington Refrigerator Co., Arlington, Vt.
Athermos. See Gurney Refrigerator Co.
Baldwin Refrigerator Co., Burlington, Vt.
Banta Refrigerator Co., Clearfield, Pa.
Belding-Hall ElectrICE Corp., Belding, Mich
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Bohn Refrigerator Co., St. Paul, Minn.
Castle Double-Servis. See Home Products Corp.
Cavalier. See Tennessee Furniture Co.
Challenge Refrigerator Co., Grand Haven, Mich.
Champion Refrigerator Co., 206 Lexington Ave., New York.
Crystal Refrigerator Co., Fremont, Neb.

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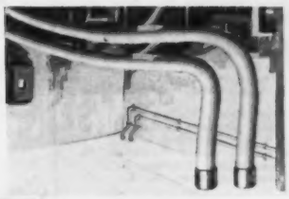

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Crysteel. See Benjamin Elec. Mfg. Co.
Dry-Air. See Baldwin Refrigerator Co.
Dry-Cold. See Hill & Co.
Economic. See Leonard Refrigerator Co.
Eddy & Sons Co., D., 336 Adams, Boston, Mass.
Erie Art Metal Co. & Erie Metal Furniture Co., Erie, Pa.
General Necessities Corp., General Necessities Bldg., Detroit, Mich.
Gibson Refrigerator Co., Greenville, Mich.
Gloekler Co., Bernard, 1627 Penn Ave., Pittsburgh, Pa.
Gurney Refrigerator Co., Fond du Lac, Wis.
Harder Refrigerator Corp., Cobleskill, N. Y.
Haskelite Mfg. Co., 120 S. La Salle, Chicago, Ill. (Knockdown.)
Heintz Mfg. Co., Front & Olney Aves., Philadelphia, Pa.
Heinz & Munschauer, Superior and Randall, Buffalo, N. Y.
Herrick Refrigerator Co., 1805 River, Waterloo, Iowa.
Hibbard Cabinets, Inc., 6504 Euclid Ave., Cleveland, O.
Hill & Co., C. V., 369 Pennington Ave., Trenton, N. J.
Holderle Bros., Inc., 339 Exchange, Rochester, N. Y.
Home Products Corp., Jackson, Mich.
Howe Scale Co., Rutland, Vt.
Jewett Refrigerator Co., Buffalo, N. Y.
Kingston. See Lorillard Refrigerator Co.
Kleen Kold. See Harder Refrigerator Corp.
Knox Products Co., Fourth & Greenhill Ave., Wilmington, Del.
Knox. See Erie Art Metal Co.
Leonard Refrigerator Co., Div. of Electric Refrigeration Corp., Grand Rapids, Mich.
Liver & Co., C. B., Omaha, Neb.
Loeber Co., Henry G., 151 E. 126th, New York, N. Y. (Ice Cream Cabinet.)
Lorillard Refrigerator Co., 44 Cooper Square, New York.
Louisville Refrigerator Corp., 4460 Louisville Ave., Louisville, Ky.
Louisville Tin & Stove Co., Louisville, Ky.
Mace & Co., L. H., 55 E. 150th, New York, N. Y.
Maine Mfg. Co., Nashua, N. H.
McCray Refrigerator Sales Corp., 2364 Lake St., Kendallville, Ind.
Mowatt Refrigerator Co., 25 Oak Grove, San Francisco, Cal.
Omaha Fixture & Supply Co., 11th and Douglas, Omaha
Oreole. See Ottenheimer Bros.
Ottenheimer Bros., Baltimore, Md.
Plymetl. See Haskelite Mfg. Co.
Ranney Refrigerator Co., Greenville, Mich.
Reel. See Ottenheimer Bros.
Reolite. See Ottenheimer Bros.
Rex Mfg. Co., Connersville, Ind.
Rexdale. See Rex Mfg. Co.
Rhinelander Refrigerator Co., Rhinelander, Wis.
Saco-Lowell Shops, Newton Upper Falls, Mass.
Sanitary Refrigerator Co., Fond du Lac, Wis.
Schmidt Co., C., John and Livingston, Cincinnati, O.
Seeger Refrigerator Co., St. Paul, Minn.
Sherer-Gillett Co., 601 W. Washington, Chicago, Ill.
Steeprest. See Heintz Mfg. Co.
Success Mfg. Co., Gloucester, Mass.
Tennessee Furniture Co., Chattanooga, Tenn.
Vogt. See General Necessities Corp.
Ward Refrigerator Co., 6901 S. Alameda, Los Angeles, Cal.
White Mountain. See Maine Mfg. Co.
White Seal. See Louisville Refrigerator Co.
REFRIGERATOR CONDENSER UNITS. See Condenser Units, Refrigerator.

REFRIGERATOR FITTINGS

Commonwealth Brass Corp., 5731 Commonwealth Ave., Detroit, Mich.

REGULATORS, Temperature

American Radiator Co., 1807 Elmwood Ave., Buffalo, N. Y. (Mercury Switch Type.)
American Telethern Co., 1017 Summit, Toledo, O.
American Thermostat Co., 226 Jelliff Ave., Newark, N. J.
Automatic Electric Heater Co., 1706 Race, Philadelphia, Pa. (Furnace.)
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Basel Mfg. Co., 911 Mulberry, Kansas City, Mo.
Boston Machine Wks. Co., 7 Willow, Lynn, Mass.
Brown. See Electric Automatic Appliance Co.
Brown Instrument Co., Wayne & Windrim, Philadelphia.
Ceaco. See Cobb Electric Appliance Co.
Cobb Electric Appliance Co., 100 Massachusetts Ave., Boston.
Cook Elec. Co., 2700 Southport Ave., Chicago, Ill.
Davis & Daggett Co., 238 Dwight, Springfield, Mass.
D. & T. Manufacturing Co., 3001 La Salle, St. Louis, Mo.
Electric Automatic Appliance Co., Denver, Col.
Engelhart, Chas., 90 Chestnut, Newark, N. J.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Fireside. See Quincy Stove Mfg. Co.
Gifford Heat Control Systems, 1 Broadway, New York.
Gold Car Htg. & Ltg. Co., 220 36th, Brooklyn, N. Y.
Hart Mfg. Co., Hartford, Conn.
Hermansen Elecl. Co., 505 W. 41st, New York, N. Y.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Jewell Mfg. Co., Auburn, N. Y.
Johnson Service Co., 149 Michigan, Milwaukee, Wis.
Lockswitch. See Time-O-Stat Controls Co.
Majestic Electric Appliance Co., San Francisco, Cal.
Marvel. See American Thermostat Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill. (Mercury Switch.)
Minneapolis-Honeywell Regulator Co., 2753 Fourth Ave., Minneapolis, Minn.
Penn Heat Control Corp., 1207 Race, Philadelphia, Pa.
Powers Regulator Co., 2720 Greenview Ave., Chicago, Ill.
Protectostat. See Minneapolis-Honeywell Reflector Regulator Co.
Quincy Stove Mfg. Co., Quincy, Ill.
Ranco. See Automatic Reclosing Circuit Breaker Co.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
Sheer Co., H. M., Quincy, Ill.
Simplex Heat Regulator, 2938 Pillsbury Ave., Minneapolis.
Snapon. See Tagliabue Mfg. Co.
Souder-Hornsby Co., Tamaqua, Pa.
Sure Fire. See Boston Machine Wks.
Tagliabue Mfg. Co., C. J., 18 33rd, Brooklyn, N. Y.
Time-O-Stat Controls Co., Cramblet Engineering Div., 286 Milwaukee Ave., Milwaukee, Wis.
Trent Co., Harold E., 439 N. 12th, Philadelphia, Pa.
Webster Elec. Co., Racine, Wis.
Wilcolator Co., 17 Nevada St., Newark, N. J.
Wilson-Mauelin Co., 383 Concord Ave., New York, N. Y.

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RELAYS

(See also Circuit Breakers and Thermostats.)
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Dunco. See Struthers Dunn, Inc.
General Electric Co., Schenectady, N. Y.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Signal Engineering & Mfg. Co., 146 W. 14th, New York
Struthers Dunn, Inc., 1133 Race, Philadelphia, Pa.
Wilcolator Co., 17 Nevada, Newark, N. J.
REMOTE CONTROL SWITCHES. See Switches, Remote Control.

REMOVERS, Coil

Ewing Mfg. Company, Middleport, Ohio.

RESISTANCE

Boxes. See Instruments, Laboratory Standard
Coil Cores. See Cores, Resistance.
Test Sets. See Instruments.
Units, Radio. See Radio Circuit Components.
Units. See Units, Rods & Grids.
Wire. See Wire Bare.

RESISTORS

Lautz Mfg. Co., 245 N. J. R.R. Ave., Newark, N. J.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill.
Ward-Leonard Electric Co., Mount Vernon, N. Y.
RESISTORS. See Units, Rods & Grids.
RESURFACERS, Commutator. See Stones, Commutator, also Tools, Commutator Truing.
REVOLUTION COUNTERS. See Tachometers.

RHEOSTATS

Motor-Controlling. See Controllers, also Rheostats.
Radio. See Radio Receiver Parts.
Sewing Machine. See Controllers.

	KEY
Battery Charging	See B
Stage Dimming	See D
Meter Testing (Laboratory)	See L
Plating Tank	See P
Motion Pictures (Projector Lamp)	See M
Motor Starting, Field and Speed Regulating	See F

	F	B	D	P	M	L
Allen-Bradley Co., 494 Reed, Milwaukee						L
Biddle, James G., 1211 Arch, Philadelphia						L
Brach Mfg. Corp., L. S., Newark, N. J. (Radio Battery Control.)		B				
Bradleystat. See Allen-Bradley Co.						
Columbia Electric Mfg. Co., 1292 E. 52nd, Cleveland, O.				P		
Controlite. See Ward Leonard Elec. Co.						
Crown Rheostat & Supply Co., 1910 Park Ave., West Chicago, Ill.				P		
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.	F	B	D			L
Economic Rheostat Switch Co., 3551 N. 5th, Philadelphia, Pa.	F					
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.	F					
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O.		B				
General Electric Co., Schenectady, N. Y.	F					L
Hanson-Van Winkle-Munning Co., Matawan, N. J.				P		
Holzmuller, C. J., 1108 Howard, San Francisco, Cal.				D		
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y.				D		M
Knoeller Elec. Co., De Pere, Wis.	F					
National Elec. Controller Co., 5315 Ravenswood Ave., Chicago	F	B	D		M	L
Optimus. See Hanson-Van Winkle-Munning Co.						
Robertson, Leo F., 536 W. 22nd, New York, N. Y.					M	
Rubicon Co., 29 W. Sixth, Philadelphia, Pa.						L
Schaefer Bros. Co., 1059 W. 11th, Chicago		B				
Simplicity. See Cutler-Hammer Mfg. Co.						
Union Elec. Mfg. Co., Milwaukee, Wis.	F					
Universal. See Ward Leonard Elec. Co.						
Vitrohm. See Ward Leonard Elec. Co.						
Ward Leonard Elec. Co., 31 South, Mt. Vernon, N. Y.	F		D		M	
Watton. See Electric Products Co.						
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.	F				M	

RINGS Seal. See Packing.

RIVETS

Chase Brass & Copper Co., Waterbury, Conn.
Chicago Rivet & Specialty Co., 1830 S. 54th, Chicago, Ill.
Hassall, Inc., John, 402 Oakland, Brooklyn, N. Y.
Hungerford Brass & Copper Co., Div. of The Chase Brass Companies, Inc., 88 Lafayette, New York, N. Y.
Manufacturers Belt Hook Co., 1315 W. Cesgrove, Chicago, Ill.
Merwin Mfg. Co., Bridgeport, Conn. (Solid & Tubular).
Nelson Rivet Co., Taunton, Mass.
Stimpson Co., Edwin B., 70 Franklin Ave., Brooklyn, N. Y.
Thomson Mfg. Co., Judson L., Waltham, Mass.
Tubular Rivet & Stud Co., 87 Lincoln, Boston, Mass.
Waterbury Brass Goods Co., Waterbury, Conn.
Wright & Corson Mfg. Co., Bridgeport, Conn.
RODS, Resistance. See Units, Rods and Grids.
ROLLER BEARINGS. See Bearings, Ball and Roller.

ROLLS, Coil Flattening

Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
RUBBER BELTS. See Belts, Rubber.

RUBBER, Hard

Hard Rubber, Ebonite, Vulcanite.
Aetna Rubber Co., 815 E. 79th, Cleveland, O.
American Hard Rubber Co., 11 Mercer, New York, N. Y.
Connecticut Hard Rubber Co., West Haven, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Luzerne Rubber Co., Muirhead, near Dewey, Trenton, N. J.
Mahoganite. See American Hard Rubber Co.
New York Hard Rubber Turning Co., 212 Centre, New York.
Panelyte Corp., Trenton, N. J.
Radionite. See Superior Hard Rubber Co.
Stokes Rubber Co., Trenton, N. J.
Superior Hard Rubber Co., Butler, N. J.
United States Rubber Co., 1790 Broadway, New York, N. Y.
Vulcanized Rubber Co., 251 4th Ave., New York, N. Y.
Vulco Panels. See Vulcanized Rubber Co.

RUBBER, MECHANICAL GOODS

Goodrich Rubber Co., B. F., Akron, O.
Republic Rubber Co., Youngstown, O.
Sun Rubber Co., Barberton, O.
RUBBER, SEMI-HARD. See Rubber Mechanical Goods.

RUBBER, Sponge

Sun Rubber Co., Barberton, O.
Voycraft Rubber Co., Ashland, O.
RUBBER TAPE. See Tape, Rubber and Friction.
RUBBER TUBING. See Tubing, Rubber.
RUST PROOFING. See Plating & Finishing.
SAL AMMONIAC. See Chemicals, Battery.
SALTS, Battery. See Chemicals, Battery.
SATURATING TANKS. See Wire Manufacturing Machines
SCREW SHELLS, Socket. See Shells, Screw Socket.

SCREW DRIVING MACHINES

Vim Electric Tool Co., 149 Broadway, New York, N. Y.

SCREW MACHINE PRODUCTS

Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh, Pa.
American Metal Wks., 4865 Stanton Ave., Philadelphia, Pa.
Barnes Co., Wallace, Bristol, Conn.
Blake & Johnson Co., Waterbury, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Brighton Screw & Mfg. Co., 1456 Harrison Ave., Cincinnati, O.
Celoron Co., Div. of Continental-Diamond Fibre Co., Bridgeport, Pa.
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Colonial-Premier Co., 225 W. Ohio, Chicago, Ill.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Hanson, Einar B., 17 Hermon, Worcester, Mass.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Indianapolis Screw Products Co., 631 N. Noble, Indianapolis.
Interstate Products Corp., 29 Commercial, Newark, N. J.
Linden & Co., 891 Broad, Providence, R. I.
Meisel Press Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Olsen Mfg. Co., 56 Commercial, Worcester, Mass.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Shimer & Sons, Samuel J., Milton, Pa.
Steiner & Co., 297 Washington, Newark, N. J.
Thomaston Mfg. Co., Thomaston, Conn.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Wilmington Fibre Specialty Co., Wilmington, Del.

SCREWS, Cap (Cut Thread)

Bristol Co., Waterbury, Conn.
Hartford Machine Screw Co., Hartford, Conn.

SCREWS, Drive

Parker-Kalon Corp., 190 Varick, New York, N. Y.

SCREWS, Machine

Chicago Nut Mfg. Co., 2513 Cullerton, Chicago, Ill.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Eleco Tool & Screw Corp., Rockford, Ill.
Hubbell, Inc., Harvey, Bridgeport, Conn.
New England Screw Co., Dept. A, 44 Farnsworth, Boston.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Strong, Carlisle & Hammond, 1392 W. Third, Cleveland, O.

SCREWS, Machine (Cut Thread)

American Screw Co., Providence, R. I.
SECOHMMETERS. See Instruments, Laboratory Standard.
SEGMENTS. See Discs, Armature.

SEPARATORS, Storage Battery

Baltimore Battery Separator Co., Baltimore, Md.
Campbell Elec. Co., Kansas City, Mo.
Carlile & Doughty, 2530 N. Broad, Philadelphia, Pa.
Chattanooga Battery Box Co., Chattanooga, Tenn.
Certified. See Ermet Products Co.
Consumers Rubber Co., 1302 Ontario, Cleveland, O.
Ermet Products Co., Sherman Drive & 16th, Indianapolis, Ind. (Wood.)
Estes & Sons, E. B., 25 Vanderbilt Ave., New York. (Wood.)
Indianapolis Box & Separator Co., 1450 E. 19th St., Indianapolis, Ind. (Wood.)
Indianapolis Mfg. Co., Indianapolis, Ind.
Inseco. See Indianapolis Box & Separator Co.
Link & Hemrick, Inc., 555 W. 52nd, New York, N. Y.
Red Band. See Indianapolis Mfg. Co.
Stewart Mfg. Co., Wm. E., 14th & Elm, Flint, Mich. (Wood.)
Wick Lumber Co., R., 539 W. 52nd, New York. (Wood.)

SHADES

Aluminum. See Shades, Metallic.
Asbestos. See Shades, Fabric.
Bamboo. See Shades, Fabric.
Brass. See Shades, Metallic.
Cast Metal. See Shades and Domes.
Copper. See Shades Metallic.
Cretonne. See Shades, Fabric.
Leaded. See Shades and Domes.
Leather. See Shades, Fabric.
Linen. See Shades, Fabric.
Mica. See Shades, Mica.
Molded. See Molded Insulation.
Mosaic. See Shades and Domes.
Paper. See Shades, Fabric.
Parchment. See Shades, Fabric.
Silk. See Shades, Fabric.

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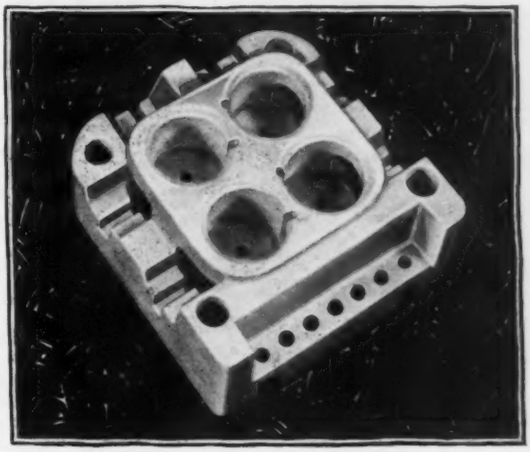

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Akron, Ohio *Established 1894*

SHADES—Continued
Stamped Metal. See Shades, Metallic; also Shades and Domes.
Steel. See Shades, Metallic.
Tin. See Shades, Metallic.
Zinc. See Shades, Metallic.

SHADES, Fabric

Asbestos Cretonne, Leather, Linen, Paper, Silk, Bamboo, Parchment.
Acme Lamp Shade Co., 630 W. Madison, Chicago. (Silk.)
Adelphi Lamp Shade Co., 242 Fifth Ave., New York. (Silk.)
Admiration Lamp Shade Co., 160 Madison Ave., New York, N. Y. (Silk.)
Andrews Co., C. M., 32 E. 30th, New York, N. Y. (Silk.)
Art Lamp Shade Studios, 316 Fifth Ave., New York, N. Y.
Audrey Art Shade Studios, 105 Thatford Ave., Brooklyn.
Block & Co., L. D., 37 E. 18th St., New York, N. Y.
Borghese. See Hall, Chas.
Daiger Co., Charles V., 76 Essex, Boston, Mass. (Silk.)
Eastern Art Shop, 14 W. 19th, New York. (Parchment.)
Foss Parchment Shade Studio, 1338 E. 12th, Oakland, Cal. (Parchment.)
Foslite. See Foss Parchment Shade Studio.
Frostelene. See Art Lamp Shade Studios.
Gilson Art Co., 223 W. Fourth, Cincinnati, Ohio. (Paper.)
Hall, Chas., 3 E. 40th, New York, N. Y. (Paper Parchment.)
Hanson Co., Paul, 15 E. 26th, New York, N. Y. (Chints.)
Harris Mfg. Co., 122 University Place, New York, N. Y. (Parchment.)
Herco Art Mfg. Co., Meriden, Conn.
Hoft Studio, 46 W. 21st, New York, N. Y. (Parchment.)
Idealite Elec. Lamp Shade Mfg. Co., 7 E. 17th, New York, N. Y. (Parchment.)
Kapa Shell. See Wardwell, E. H.
Kerwin. See Hall, Chas.
Kno-Glair. See Hamilton, M. E.
Lamb Bros. & Greene Corp., Napannee, Ind. (Silk.)
Luxrite. See John H. St. John.
Maxwell-Ray Co., Milwaukee, Wis. (Silk.)
Monarch Lamp & Shade Co., 210 N. Second, Philadelphia, Pa. (Silk.)
Morimura Bros., 58 W. 23rd, New York. (Bamboo, Silk, Cretonne.)
Parchment Novelty Co., 87 E. 10th, New York, N. Y. (Parchment.)
Patent Lamp Shade Co., 1361 Frankford Ave., Philadelphia.
Peerless Lamp Shade Mfg. Co., 114 E. 25th, N. Y. (Silk.
R. D Electric Co., Fort Wayne, Ind. (Linen and Silk.)
Reuter, Wm., 32 W. 34th, New York, N. Y. (Silk.)
Rindsberger Mfg. Corp., 22 E. 24th, Chicago, Ill.
Rosita Studio, 10 W. 28th, New York, N. Y. (Parchment and Leatherette.)
Sanderson's Art Co., Milwaukee, Wis. (Parchment.)
Springel & Son, A., 26 S. 3rd, Philadelphia, Pa.
St. John, John H., 1298 Atlantic Ave., Brooklyn, N. Y. (Silk.)
Straus-Hohenstein Co., 133 W. 21st, New York. (Silk.)
Superior Lamp Shade Manufacturers, 72 Madison Ave., New York, N. Y. (Silk.)
Tapestrelle Corp., 44 E. 29th, New York, N. Y.
Tombs Studios, Wm. H., 172 Pennsylvania Ave., Newark, N. J. (Parchment Paper.)
Trio Mfg. Co., 610 N. American, Philadelphia, Pa. (Silk.)
Troy Art Studio, 624 2d Ave., Troy, N. Y.
Utility Shade Co., Tenafly, N. J.
Vogue Lamp & Shade Co., 130 W. 17th, New York, N. Y. (Parchment.)
Volkman Co., 3223 W. Lake, Chicago, Ill.
Wardwell, E. H., 11 E. 36th, New York, N. Y.

SHADES AND DOMES

Leaded, Mosaic or Figured, Stamped or Cast Metal.
Art Shade Co., 223 N. Desplaines, Chicago, Ill.
Badanes Mfg. Co., 62 Greene, New York, N. Y.
Bayley & Sons, 105 Vanderveer, Brooklyn, N. Y.
Mutual Sunset Lamp Co., 21 E. Houston, New York, N. Y.
Royal Art Glass Co., 2572 Park Ave., New York, N. Y.
Western Art Glass Shade Works, 101 Turk, San Francisco.
SHADES, FACTORY WINDOW. See Window Shades, Factory.

SHADES, Metallic

Tin, Aluminum, Brass, Copper, Zinc, Steel.
A. A. Elec. Mfg. Co., Bridgeport, Conn. (Sole selling agent, Harry Pickhardt, 129 W. 15th, New York, N. Y.)
Durex. See Wheeler Reflector Co.
Faries Mfg. Co., Decatur, Ill. (Brass, Aluminum, Tin, Copper.)
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. (Aluminum, Brass, Zinc, Iron, Steel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Aluminum, Brass, Steel, Tin.)
Miller Co., Meriden, Conn.
Monk, H. E., 18 Warren, New York, N. Y. (Tin, Aluminum, Brass, Copper, Zinc & Steel).
Osmco. See Overbaugh & Ayres Mfg. Co.
Overbaugh & Ayres Mfg. Co., 411 S. Clinton, Chicago, Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Western Reflector Co., 1221 W. Madison, Chicago. (Tin.)
Wheeler Reflector Co., 275 Congress, Boston, Mass.

SHADES, Mica

Hirsch Mica Co., 1087 Flushing Ave., Brooklyn, N. Y
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
Kant-Krack. See Huse Liberty Mica Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co., Plumtree, N. C.
Tarmilite. See Tar Heel Mica Co.
SHAFT COUPLINGS. See Couplings, Shaft.
SHAFTS, Flexible. See Tubing, Flexible Metallic.

SHAPING MACHINES, Coil

Munsdorf Company, W. P., 720 Frankfort, Cleveland, Ohio.

SHEARS, Insulation

Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
SHEET STEEL CABINETS. See Cabinets, Sheet Steel

SHELLS, Screw Socket

Chase Brass & Copper Co., Waterbury, Conn.
Dallas Brass & Copper Co., 820 Orleans, Chicago, Ill.
Paxton-MacGuyer Co., Providence, R. I.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Torrington Mfg. Co., 70 Franklin, Torrington, Conn
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., 800 S. Main, Waterbury, Conn (Miniature.)
SHUNTS, Instruments. See Instruments, Laboratory Standard.

Fair Haven Marble & Marbleized Slate Co.
Fair Haven Vermont
SLATE GOODS

PORTLAND-MONSON SLATE CO.
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Monson Slate
for Electrical
Purposes, Natural
Black, Oil Finish
Quarries:
Monson, Maine
Office, Portland, Maine

SIGN FLASHERS. See Flashers, Sign.
SIGN LETTER LENSES. See Lenses.

SILICA

Ottawa Silica Co., Ottawa, Ill. "Flint Shot."
SILK, Cloth Insulated. See Cloth & Paper.
Shades. See Shades, Fabric.
Tape. See Tape.
Thread. See Yarn, etc.

SILVER, Metal and Wire

Baker & Co., Inc., 54 Austin, Newark, N. J.
Gilby Wire Co., Riverside Ave., Newark, N. J.
Handy & Harman, 57 William, New York, N. Y.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.
SILVER SOLDER. See Solder, Silver.
SINE WAVE OSCILLATORS. See Instruments, Laboratory Standard.
SKINNERS WIRE. See Scrapers.
SLABS, Switchboard. See Asbestos Slabs; also Molded Insulation, Slate; Soapstone.

SLATE

For Switchboard Slabs and Barriers.
Davis Slate & Mfg. Co., 618 E. 40th, Chicago, Ill.
Electrical Specialties Corp., 50 Pearl, Boston, Mass.
Fair Haven Marble & Marbleized Slate Co., Fair Haven, Vt
Penrhyn Slate Co., Hydeville, Vt.
Portland-Monson Slate Co., Portland, Me.
structural Slate Co., Pen Argyl, Pa.
SLEEVE-BEARINGS. See Bearings and Bushings.
SLEEVING, Cotton. See Tape, Cotton.
SLOTTING FILES. See Files, Commutator Slotting.

SLOTTING MACHINES and TOOLS, Commutator

(Mica Undercutters).
Allen Electric & Equipment Co., Kalamazoo, Michigan
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
Hobart Bros. Co., Troy, Ohio.
Hullhorst Micro Tool Co., 3240 E. Monroe, Toledo, O
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Imperial. See Martindale Elec. Co.
Martindale Electric Co., 1255 W. Fourth, Cleveland, Ohio.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn
Peerless. See Electric Service Supplies Co.
Ransom & Randolph Co., Superior & Chestnut, Toledo, Ohio
Simplex. See Weldenhoff, Joseph.
Weldenhoff, Joseph, 4352 Roosevelt Rd., Chicago Ill
White Dental Mfg. Co., S. S., 152 W. 42nd, New York.
SNAP SWITCHES. See Switches, Snap

SOAPSTONE

For Switchboard Slabs and Barriers.
Alberene Stone Co., 153 W. 23rd, New York, N. Y.
Kirchberger & Co., Inc., 1425 37th, Brooklyn, N. J.
Lin-Stun. See Westinghouse.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa
SOCKET LININGS. See Linings, Socket
SOCKET SHELLS. See Shells, Screw Socket.
SOCKETS, Flashing. See Flashers, Sign.

SOCKET Chain Attachments

Chain Links, Chain Adjusters, Acorns, Extensions, Insulated Chain Splicers.
Abbott. See Harvey Hubbell, Inc.
American Brass Co., 25 Broadway, New York, N. Y. (Acorns.)
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Bryant Electric Co., Bridgeport, Conn.
Duplex. See Warner Bros. Co.
Wade, John E., 104 Point, Providence, R. I. Links, Insulators
Easylite. See Rittenhouse Co., A. E.
Economy. See Harvey Hubbell, Inc.
Flory, Wm. E., 38 W. 32nd, New York, N. Y. (Decorative Pull Chains.)
Gripper. See Wittenberg Bros.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. (Metal Pull Tassel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Links and Acorns. Metal Pull Tassels.)
Paiste. See Hart & Hegeman Mfg. Co.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y. (Pull Chain Tassel.)
P. & S. See Pass & Seymour, Inc.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Royal. See Sears, Henry D.
Scovil Mfg. Co., Waterbury, Conn. (Acorn.)
Sears, Henry D., 50 Boylston, Boston, Mass.
Weber. See Sears, Henry D.
Wittenberg Bros., 60 Shipman, Newark, N. J. Links, Insr-

SOCKET REDUCERS

Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Can-del-lite. See Sears, Henry D.
Eagle Electric Mfg. Co., 59 Hall, New York, N. Y.
Electric Co., 94 Allyn, Hartford, Conn.
General Electric Co., Merchandise Dept., Section W-234 Bridgeport, Conn.
Hart & Hegaman Div. of Arrow-Hart & Hegeman Elec. Co. Hartford, Conn.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Pass & Seymour, Solvay Sta., Syracuse, N. Y.
Propp Co., M., 524 Broadway, New York, N. Y.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sears, Henry D., 50 Boylston, Boston, Mass.

SOCKETS, Radio. See Radio Receiver Parts.

SOCKETS AND RECEPTACLES, Lamp

Bases other than Standard (or Medium) are indicated as follows: Mogul, M; Candelabra (or Miniature), C.

Key	See K
Composition	See W
Metal Shell	See B
Porcelain	See A
Pull Chain	See P
Push Through	See T
Sign Receptacles	See A

A. B. C. See Leviton Mfg. Co.
Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. . . . . A
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo. . . . . W . . . . . .
Alabax. See Arrow Elec. Co.
Appleton Electric Co., 1730 Wellington Ave., Chicago, Ill. . . . . A
Armstrong & White, 9th and Liberty Ave., Pittsburgh, Pa. . . . . A
Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. M C K T P B A
Arregrip. See Arrow Elec. Co.
A. & W. See General Outdoor Adv. Co.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. . . . . C . . . P B .
Best. See United States Elec. Mfg. Corp.
Bryant Elec. Co., Bridgeport. . . . . M C K T P B A
C-H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. . . . M . . K T P B A
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. . . . . .
Connecticut Elec. Mfg. Co., Bridgeport, Conn. . . . . M . . K T . . B A
Crouse-Hinds Co., Syracuse, N. Y. . . A W . . . . . .
Cutler-Hammer, Inc., 1287 St. Paul Ave., Milwaukee, Wis. . . . . K T . . B A
Durex. See Wheeler Reflector Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y. . . . . .
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. . . . . P B . .
Far-Go Elec. Mfg. Co., 368 Broome, New York, N. Y. . . . . C . . . . . .
Federal Electric Co., 8700 S. State, Chicago, Ill. . . . . A
Flute. See Pass & Seymour.
Flutelier. See Pass & Seymour.
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. . . . . M C . . . . . B . .
Gaynor Elec. Co., Bridgeport, Conn. . . . . .
General Elec. Co., Section W-234 Merchandise Dept., Bridgeport, Conn. . . M C K T P B A
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. . . . . M C K T P B A
Hoosick Falls Radio & Elec'l Parts Mfg. Co., Hoosick Falls, N. Y. . . . W . . . . . .
Hubbell, Inc., Harvey, Bridgeport, Conn. M C K T P B A
H. & H. See Hart & Hegeman.
I-D-A. See Watson Mfg. Co., J. E.
K-E Cleat Receptacle. See Kirkman.
Kirkman Engineering Co., 1 Dominick, New York. (Cleat Receptacle.) . . . . . .
Leader. See Leviton Mfg. Co.
Leiser & Co., W. A., 1607 Sansom, Philadelphia, Pa. . . . . A
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y. . . . . M C K . . P B A
Levolier. See McGill Mfg. Co.
Liberty Bell. See Hart & Hegeman.
Locat-A-Catch. See Connecticut.
McGill Mfg. Co., Valparaiso, Ind. . . . . P B A
Majestic Elec. Mfg. Co., 806 N. 12th, St. Louis. (Lamp Receptacle.) . . . . . A
Molded Socket Corp., Railroad, Pa. . . . . K . . . . . .
Multi Elec'l Mfg. Co., 1840 W. 14th, Chicago, Ill. . . . . A
Multilok. See Circle F Mfg. Co.
Newgard. See Multi Elec'l Mfg. Co.
New Wrinkle. See Bryant Elec.
Noark. See Colt's Patent Fire Arms.
One 4 All. See Propp Co., M.
P. & S. See Pass & Seymour.
Pass & Seymour, Solvay Station, Syracuse, N. Y. . . . . M C K T P B A
Paulding, John I., New Bedford, Mass. . . . . B A
Perkins. See Bryant Elec. Co.
Porcelain Products, Inc., Findlay, O. . . . . A
Propp Co. M., 524 Broadway, New York, N. Y. . . . . .
Quick Catch See Hubbell, Inc.
Royal. See Sears, Henry D.
Ryan Appliance Co., 117 Mulberry, Trenton, N. J. . . . . W . . . . . A
Safti Sox. See Molded Socket Corp.
Sears, Henry D., 80 Boylston, Boston M C K T P B A
Security. See Circle F Mfg. Co.
Shurlock. See Pass & Seymour.
Siemen Co., Bridgeport, Conn. . . . . .
Taplet Mfg. Co., 3709 Powelton Ave., Philadelphia, Pa. . . . . A
Titan. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. . . . . A
Union Insul. Co., Parkersburg, W. Va. . . . . A
United States Elec. Mfg. Corp., 322 W. 14th, New York, N. Y. . . . . P . . B . . W
U. S. Electric Co., 311 Chambers St., Trenton, N. J. . . . . A
Walco. See Leiser & Co., W. A.
Waterbury Button Co., Waterbury, Conn. . . . . .
Watson Mfg. Co., J. E., 5506 N. Fifth, Philadelphia, Pa. (Concealed Fixture) . . . . . P B . .
Weber. See Sears, Henry D.
Wheeler Reflector Co., 275 Congress St., Boston, Mass. . . . . P . . .
Wiring Devices, Inc., 5 High, Trenton, N. J. . . . . A
Wood Electric Co., C. D., 585 Broadway, New York. (Sign Receptacles.) . . . . . A
Woodwin. See Wood Elec. Co.
Wrinklet. See Bryant Elec. Co.

SOLDER, Aluminum

Allen Co., Inc., L. B., 6750 Bryn Mawr Ave., Chicago, Ill.

Electrical SLATE
Large Stocks—Quick Deliveries. Send your Slate orders to us.
DAVIS SLATE & MFG. CO.
618 East 40th St., Chicago, Ill.

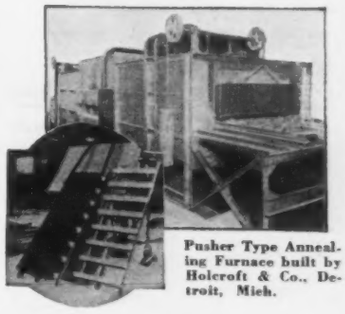
Emphasizing Essentials

Two points about our refractories we spotlight for your attention. The materials we use, and the way we use them. In other words, their *character* and *quality*.

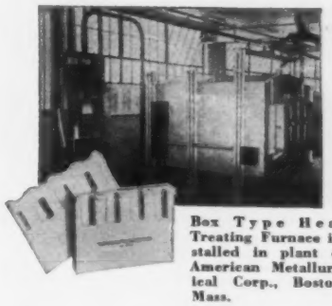
THE electrical refractories we make are capable of resisting voltage at high temperatures. They sustain continuous cooling without spall or spit-off. They have the mechanical strength to support the heating elements at high temperatures. They are moulded with uniform accuracy, with no sharp edges left to injure the metallic resistor.

These results show the character and quality of our products—results which are exemplified in the installations illustrated at the right. The largest electrical manufacturers in the country are utilizing our experience and craftsmanship; and our admirably located and modernly equipped plant can be made a part of your organization as well. If you have a special problem, consult with us on it.

We make a complete line of refractories for electric ranges and other domestic appliances, and also tubes and cores for all types of resistance windings. Of special importance are our refractory heating element supports for electric furnaces.



Pusher Type Annealing Furnace built by Holcroft & Co., Detroit, Mich.



Box Type Heat Treating Furnace installed in plant of American Metallurgical Corp., Boston, Mass.

SOLDER, Aluminum—Continued
Aluminum Solder Corp. of America, 730 Fifth Ave., New York, N. Y.
Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
Platt Bros. & Co., Waterbury, Conn.
Solderlume. See Aluminum Solder Corp. of America.
Union Smelting & Refining Co., Newark, N. J.
Usarco. See Union Smelting & Refining Co.

SOLDER, Bar and Wire

Eagle. See Hoyt Metal Co.
Genuine A. See Hoyt Metal Co.
Hoyt Metal Co., St. Louis, Mo.

SOLDER, Self-Fluxing

American Solder & Flux Co., 2910 N. 16th, Philadelphia.
Dutch-Boy. See National Lead Co.
Gardiner Metal Co., 1366 W. Lake, Chicago, Ill.
Kester Solder Co., 4210 Wrightwood Ave., Chicago, Ill.
Lenk Mfg. Co., 32 Merrimac, Boston, Mass.
National Lead Co., 111 Broadway, New York, N. Y.
Solderall Co., 129 Sussex Ave., Newark, N. J.
Tinol. See American Solder & Flux Co.

SOLDER, Silver

Handy & Harman, 57 William, New York, N. Y.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.
SOLENOIDS. See Coils, Finished.

SOLDERING
Compounds. See Soldering Compounds.
Irons. See Soldering Irons.
Machines. See Soldering Machines, Commutator
Tools. See Torches and Furnaces.

SOLDERING COMPOUNDS

Stick Paste, Flux Salts, Fluid.
Allen Co., Inc., L. B., 6750 Bryn Mawr Ave., Chicago, Ill. (Soldering, Stick Paste, Salts, Liquid Oil, Welder, Aluminum Flux, Fountain Brushes.)
American Solder & Flux Co., 2910 N. 16th, Philadelphia, Pa. Flux, Paste, Salts.
Amco. See American Solder & Flux Co.
Anchor. See Garden City Laboratory.
Benson Co., Alex R., Hudson, N. Y. (Salts and Paste.)
Burnley Battery & Mfg. Co., North East, Pa. Paste and Stick.
Brunner Chemical Wks., 217 E. 3rd, Cincinnati, O.
Callahan & Co., Geo., 218 Front, New York. (Fluid.)
Central Stamping Co., 206 Broadway, New York, N. Y. Paste and Salts.
Challenge. See Highland Electro Chemical Co.
Conductalute. See Technical Products Co.
Crescent. See McGill Mfg. Co.
Diamond. See Burnley Battery & Mfg. Co.
Dielectric Mfg. Co., St. Louis, Mo.
Dunton Co., M. W., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Eureka. See Grasselli Chemical Co.
Firth Radio Corp., 25 Beaver, New York, N. Y.
Fluxite. See Monarch Products Co.
Garden City Laboratory, 300 W. Adams, Chicago, Ill.
General Elec. Co., Section W-234, Merchandise Dept., Bridgeport, Conn. (Paste).
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Highland Electro Chemical Mfg. Co., Connellsville, Pa. (Paste, Stick, Salts.)
Incomparable. See Reade Mfg. Co.
Leveridge, Inc., Chas. W., 246 Fulton, New York, N. Y.
Luco. See Lukens Metal Co.
Lukens Metal Co., T. F., 1105 Fairmount Ave., Philadelphia, Pa.
McGill Mfg. Co., Valparaiso, Ind. Fluid.
Mitchell-Rand Mfg. Co., 19 Vesey, New York. (Paste.)
Monarch Products Co., Red Bank, N. J.
Neutral. See Dielectric Mfg. Co.
New-Idea. See Hartwig Co., Wm. J.
Nokorode. See Dunton Co., M. W.
Oakwood. See Weaver Specialty Co.
Paragon Insulating Co., 5716 Euclid Ave., Cleveland, O.
Perfecto. See Firth Radio Corp.
Pfanstiehl Chemical Co., Waukegan, Ill. Paste, Salts, Sticks, Fluid, Oil, and Solid Sal Ammoniac.
Queens. See Brunner Chemical Works.
Reade Mfg. Co., 133 Hoboken Ave., Jersey City, N. J. (Fluids, Salts, Paste).
Redens. See Reade Mfg. Co.
Red-Letter. See Ruby Chemical Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y. (Paste.)
Rotax Mfg. Co., 380 E. 133rd, New York, N. Y.
Ruby Chemical Co., Columbus, O.
Ruby Fluid. See Ruby Chemical Co.
Salbrick. See American Solder & Flux Co.
Silva-Wares, Inc., 134 W. 26th, New York, N. Y.
Snarr & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. (Paste.)
Snowflake. See Grasselli Chemical Co.
Snowflake. See Highland Electro Chemical Co.
Solderine. See Central Stamping Co.
Solderite, Inc., 32 Green, Newark, N. J.
Speco. See Pfanstiehl Chemical Co.
Standard. See Grasselli Chemical Co.
Star. See McGill Mfg. Co.
Superior. See Highland Electro Chemical Co.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa. (Paste.)
Tinol. See American Solder & Flux Co.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago, Ill.
Weaver Specialty Co., 6344 Aurelia, Pittsburgh, Pa.
Yager's. See Benson Co., Alex. R.
Yankee. See Leveridge, Inc., Chas. W.

SOLDERING IRONS

Acme Elec. Heating Co., Dept. B, 1217 Washington, Boston.
Adroit. See Adrola Corp.
Adrola Corp., Port Jefferson, N. Y.
American Beauty. See American Elect. Heater Co.
American Elect. Heater Co., Detroit, Mich.
B-D. See Bleadon-Dun Co.
Beardsley & Wolcott Mfg. Co., Waterbury, Conn.
Beckwith Machine Co., 402 N. Chestnut, Ravenna, Ohio.
Betsy Ross. See Central Flatiron Mfg. Co.
Bleadon-Dun Co., 2300 Warren Ave., Chicago, Ill.
Brach Mfg. Corp., L. S., Newark, N. J.
Burnley Battery & Mfg. Co., North East, Pa.
Central Flatiron Mfg. Co., Johnson City, N. Y.
Chapman Machine Co., Terryville, Conn.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Davis Specialty Works, East Gary, Ind.
Dominion Elec'l Mfg. Co., 712 Ontario Ave., N., Minneapolis.
Dover Mfg. Co., Dover, O.

Drake Elec. Wks., 3943 Lincoln Ave., Chicago, Ill.
Edison Elec. Appliance Co., 5600 W. Taylor, Chicago, Ill.
Electrahot Mfg. Co., 525 S. 4th, Minneapolis, Minn.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland. (Transformer Soldering Outfit.)
Electric Soldering Iron Co., Inc., 135 W. 17th, New York.
Electrical Products Mfg. Co., Providence, R. I.
Enco. See Electrical Necessities Corp.
Esico. See Electric Soldering Iron Co.
Everhot. See Swartzbaugh Mfg. Co.
Ever-Ready. See Gold Seal Elec. Co.
General Electric Co., Schenectady, N. Y.
Gold Seal Elect. Co. of Ohio, Inc., 250 Park Ave., New York, N. Y.
Hemac. See Majestic Elec. Appliance Co.
Illinois Stamping & Mfg. Co., 220 N. Jefferson, Chicago, Ill.
Industrial. See Permway Mfg. Co.
Jiffy. See Koch & Co., Paul W.
Junior. See Drake Elec. Wks.
King. See Electric Heat Control Co.
Koch Co., Paul W., 23 S. Wells, Chicago. (Solder Dipper).
Landers, Frary & Clark, New Britain, Conn.
Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
Lotan. See Simplex Flux & Solder Co. of America.
Lucifer. See Jones Point Tool & Elec. Co.
Majestic Electric Appliance Co., San Francisco, Cal.
Manning-Bowman & Co., Meriden, Conn.
Mechanics. See Drake Elec. Wks.
Moto-Ray Mfg. Co., 169 Massachusetts Ave., Boston, Mass.
National Specialties Co., Howell & Tyler Sts., Fort Wayne, Ind.
Northern Elec. Co., 2833 N. Western Ave., Chicago, Ill.
Queen Quality. See Watlow Elec. Mfg. Co.
Quick-Hot. See Moto-Ray Mfg. Co.
Radio. See Drake Elec. Wks.
Regular. See National Specialties Co.
Reliance. See Landers, Frary & Clark.
Samson Cutlery Co., 8 Jones St., Rochester, N. Y.
Security Elec. Mfg. Co., 2633 Canton, Chicago, Ill.
Silver King. See Illinois Stamping & Mfg. Co.
Simplex Flux & Solder Co. of America, 1965 E. 66th, Cleveland, O.
Superior Elec. Products Corp., 1300 S. 13th, St. Louis, Mo.
Swartzbaugh Mfg. Co., 1501 W. Bancroft, Toledo, O.
Torrid. See Beardsley & Wolcott Mfg. Co.
Trent, Harold E., 295 N. Lawrence, Philadelphia, Pa.
Varick Elec. Mfg. Co., 28 E. 21st St., New York, N. Y.
Vulcan Elec. Heating Co., 225 Varick, New York, N. Y.
Waage Elec. Co., 5100 W. Ravenswood Ave., Chicago, Ill.
Ward Mfg. Co., 937 Wellington Ave., Chicago, Ill.
Watlow Elec. Mfg. Co., 1320 N. 23rd, St. Louis, Mo.
Wellmade Elec. Co., Torrington, Conn.

SOLDERING MACHINES, Commutator

(For production soldering of small commutators).
Allstonce. See Chapman Electric Works, P. E.
Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
SOLENOIDS. See Coils
SOLVENTS & REDUCERS, VARNISH. See Paint, Varnish, Lacquer.
SPAGHETTI. See Tubing, Varnished Fabric.
SPEED CHANGING UNITS. See Gears (Speed Changing Units).
SPEED INDICATORS. See Tachometers.
SPOOLING MACHINES, WIRE. See Wire Manufacturing Machines.

SPRAYING OUTFITS

Airway. See Binks Spray Equip. Co.
Babco. See Simons Paint Spray Brush Co.
Beach Air Brush Co., Willard C., Harrison, N. J.
Binks Spray Equipment Co., 3120 Carroll Ave., Chicago, Ill.
De Vilbiss Mfg. Co., 3750 Detroit Ave., Toledo, Ohio.
Eclipse Air Brush Co., 79 Orange, Newark, N. J.
Electric Sprayit Co., 820 E. Colfax Ave., South Bend, Ind.
Eureka Sprayers, Inc., 87-28 130th, Long Island City, N. Y.
Ideal Air Brush Mfg. Co., 203 Lafayette, New York, N. Y.
Kellogg Mfg. Co., 97 Humboldt, Rochester, N. Y.
Koch Bros. Mfg. Co., 2339 Nelson, Chicago, Ill.
K B. See Koch Bros. Mfg. Co.
Metal Specialties Mfg. Co., 338 N. Kedzie Ave., Chicago.
Macleod Co., 2232 Bogen, Cincinnati, O.
Paasche Air Brush Co., 1911 Diversey Parkway, Chicago, Ill.
Pioneer Air Compressor Co., 176 Grand, New York, N. Y.
Presto. See Metal Specialties Mfg. Co.
Simons Paint Spray Brush Co., 17 Maryland Ave., Dayton, O.
Simplex Spray Equipment Co., 552 W. Lake, Chicago, Ill.
Sprayit. See Electric Sprayit Co.
United States Air Compressor Co., 5300 Howard Ave., Cleveland, O.
Wold Air Brush Mfg. Co., 2173 N. California Ave., Chicago, Ill.
SPREADERS, COIL & LOOP. See Winding Machines Armature & Field Coil.

SPRING MAKING MACHINES

Sleeper & Hartley, Inc., Worcester, Mass.

SPRINGS,

Advance Spring & Wire Co., Carroll Ave. & Wood St., Chicago.
Barnes-Gibson-Raymond, Inc., 6400 Miller Ave., Detroit, Mich.
Cary Spring Works, Inc., 240 W. 29th St., New York, N. Y.
Chapin Co., Chas. E., 227 Fulton, New York, N. Y.
Cleveland Wire Spring Co., Cleveland, O.
Cook Spring Co., Ann Arbor, Mich.
Cuyahoga Spring Co., Berea Rd., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Eureka Tinware Mfg. Co., 135 W. 20th, New York, N. Y.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Gibson Co., Wm. D., 1800 Clybourn Ave., Chicago, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.
Lee Spring Co., 34 Main, Brooklyn, N. Y.
Miller & Van Winkle, Inc., 18 Bridge, Brooklyn, N. Y.
Newcomb Spring Corp., 234 40th, Brooklyn, N. Y.
Peck Spring Co., Plainville, Conn.
Peterson Spring Co., 1660 Beard Ave., Detroit, Mich.
Rapid Spring Co., 222 Second Ave., Pittsburgh, Pa.
Raymond Mfg. Co., Corry, Pa.
Standard Spring and Manufacturing Co., 236-42nd St., Brooklyn, N. Y.
Steinen & Co., 297 Washington, Newark, N. J.
Wallace Barnes Co., Bristol, Conn.
Young Industries, Inc., L. A., Detroit, Mich.
STAMPED BOXES. See Cabinets, Sheet Steel.
STAMPINGS, Fibre. See Fibre.
Sheet Metal. See Fixture Fittings.
Sheet Steel. See Stampings, Sheet Steel.
Small. See Stampings, Small.

STAMPINGS, Sheet Steel

Heavy Stamping and Drawing.
Acklin Stamping Co., 1925 Nebraska, Toledo, O.
American Stamping Co., 978 E. 64th, Cleveland, O.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bossert Corp., Utica, N. Y.
Eureka Tinware Mfg. Co., 135 W. 20th, New York, N. Y.
Faries Mfg. Co., Decatur, Ill.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
Hubbard & Co., Pittsburgh, Pa.
Janney, Steinmetz & Co., 1421 Chestnut St., Philadelphia.
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn.
Mullins Mfg. Corp., Washing Machine Division, Salem, Ohio. (Vitreous Enameled)
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
Truscon Steel Co., Youngstown, O.

STAMPINGS, Small

Small Stamped Metal Parts for Electrical Devices.
Advance Tool & Die Casting Co., 1654 Holton, Milwaukee.
Aerial Machine & Tool Co., 70 Grand, New York, N. Y.
American Emblem Co., Utica, N. Y.
American Radio Hardware Co., 135 Grand, New York, N. Y.
American Stamping Co., 978 E. 64th, Cleveland, O.
Arrow Automatic Products Corp., 27 Vestry, New York, N. Y.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Bull Dog Electric Products Co., Detroit, Mich.
Chase Brass & Copper Co., Waterbury, Conn.
Clarke Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Elco Tool & Screw Corp., Rockford, Ill.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Gray Bros. Co., Plano, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Krischer's Mfg. Co., 355 Calyer, Brooklyn, N. Y.
Lansing Stamping Co., Lansing, Mich.
Lenz Metal Stamping Wks., J., 199 Franklin, New York.
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Mechanics Tool & Stamping Co., 7 Summer, Worcester, Mass.
Mutual. See Bull Dog Elec. Products Co.
Patton-MacGuyer Co., Providence, R. I.
Paul & Beekman Mfg. Co., 1734 N. Fifth, Philadelphia, Pa.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Precision Metal Workers, 3100 Carroll Ave., Chicago, Ill.
Premax Products, Inc., Niagara Falls, N. Y.
Quadriga Mfg. Co., 213 W. Grand Ave., Chicago, Ill.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Signal Elec. Mfg. Co., Menominee, Mich.
Steinen & Co., 297 Washington, Newark, N. J.
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
United Stamping & Mfg. Co., Cleveland, Ohio.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., Waterbury, Conn.
Waterbury Mfg. Co., 236 Grand, Waterbury, Conn.
Waterbury Metal Wares Co., Waterbury, Conn.
Zierick Machine Wks., F. R., 68 E. 131st St., New York, N. Y.

STANDS, Armature

Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17 & Cambria Sts., Philadelphia, Pa.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ridlon Company, Frank, Boston, Mass.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.
STARTERS, Motor. See Controllers, Motor; Switches, Remote Control; Switches, Knife; Safety; Switches, Snap (Heavy Duty).
STEATITE. See Cores, Resistance Coil.
STEEL CASTINGS. See Castings, Steel.

STEEL for Electric Appliances

Elyria Iron & Steel Co., Elyria, O.
Ryerson & Son, Jos., 2558 W. 16th, Chicago, Ill.

STEEL, Magnet

Ajax Electrothermic Corp., Trenton, N. J.
Hercules Elec. Steel Corp., 145 Lafayette St., New York.
Indiana Steel Products Co., 4545 S. Western Ave., Chicago.
Ludlum Steel Co., Watervliet, N. Y.

STEEL SHEETS

Agathon. See Central Alloy Steel Corp.
Allegheny Steel Co., Brackenridge, Pa.
American Rolling Mill Co., Middleton, Ohio.
American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh.
Armelec. See Empire Steel Corp.
Central Alloy Steel Corp., Massillon, O.
Cyclops Steel Co., Titusville, Pa.
Dynelec. See Empire Steel Corp.
Empire Steel Corp., Mansfield, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Manelec. See Empire Steel Corp.
Metelec. See Empire Steel Corp.
Newport Rolling Mill Co., Newport, Ky.
Polelec. See Empire Steel Corp.
Republic Iron & Steel Co., 335 Market, Youngstown, O.
Tranelec. See Empire Steel Corp.
Unilov. See Universal Steel Co.
Universal Steel Co., Bridgeville, Pa.
Wheeling Steel Corp., Wheeling, W. Va.
STEEL, STRIP. See Strip Steel.

STOCKS, Dies and Reamers

Hall-Will, Inc., Erie, Pa.
Red-E-Hall. See Hall-Will, Inc.
Toledo Pipe Threading Machine Co., 1445 Summit, Toledo, O.

STONES, Commutator

Acme. See Green Equipment Corp.
Caro. See Electric Service Supplies Co.
Cleveland Stone Co., Union Trust Bldg., Cleveland, O.
Co-operative Utilities Co., 1503 Columbia Ave., Philadelphia, Pa.
Diamond Dee. See Co-operative Utilities Co.
Electric Service Supplies Co., 17th and Cambria, Philadelphia, Pa.

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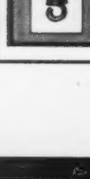
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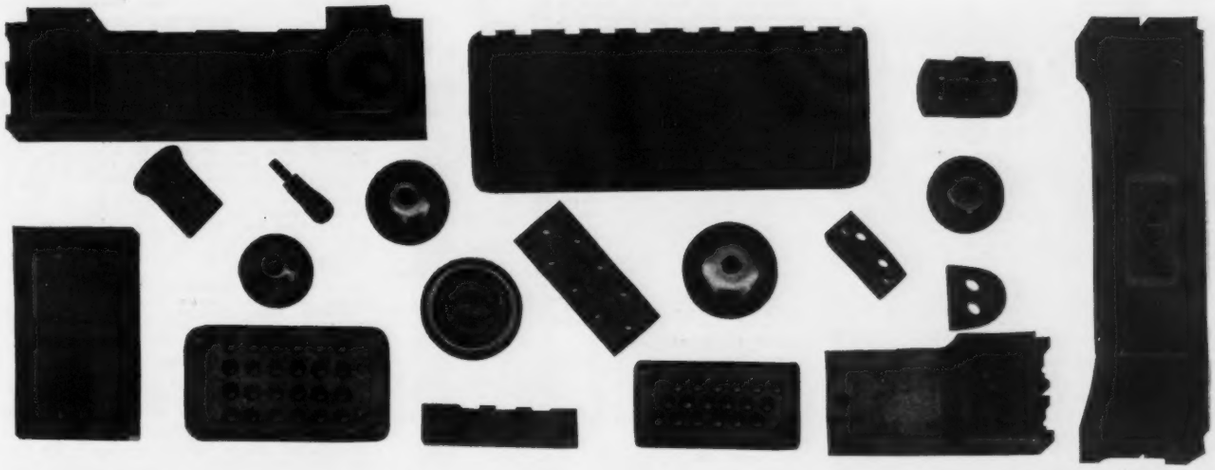

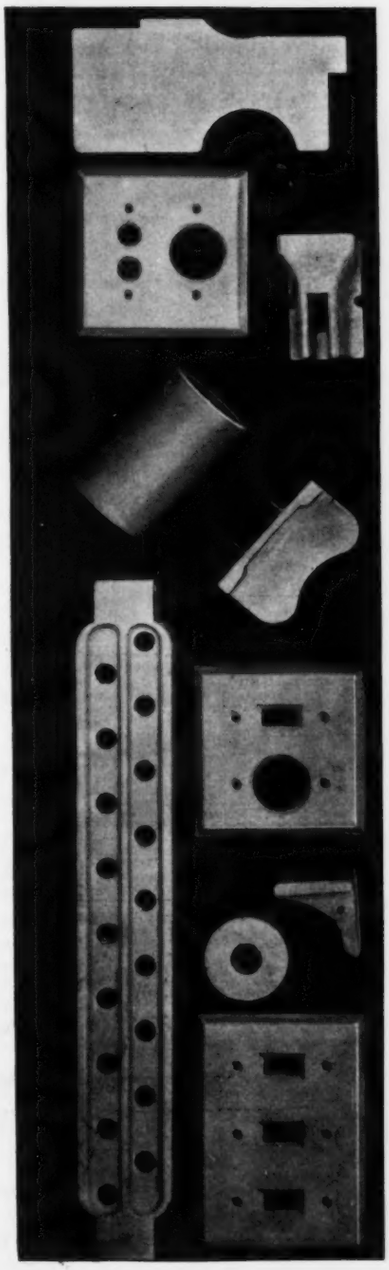

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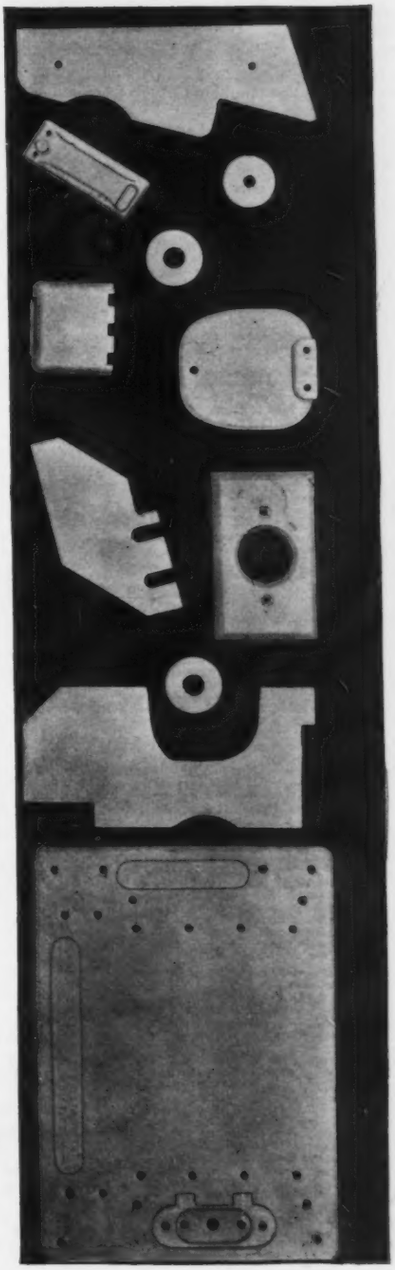
Branches in Principal Cities



STONES, Commutator—Continued
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Imperial. See Martindale Electric Co.
Lombard & Co., Somerville, Mass.
Martindale Elec. Co., 1255 W. Fourth, Cleveland, O.

STOOLS, Factory; Steel

Angle Steel Stool Co., Plainwell, Mich.
Chicago Wire Chair Co., 613 N. La Salle, Chicago, Ill.
Royal Metal Mfg. Co., 1136 South Michigan Ave., Chicago, Ill.

STORAGE
Battery Plates. See Plates, Storage Battery.
Battery, Separators. See Separaters.
Tools. See Tools, Storage Battery.

STRAINING MACHINES, INSULATION. See Wire Manufacturing Machines.

STRAIGHTENERS, Armature Shaft

Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut st., Brooklyn, N. Y.

STRANDING MACHINES. See Wire Manufacturing Machines.

STRIP STEEL

(Hot and Cold Roll).
Acme Steel Co., 2840 Archer Ave., Chicago, Ill. (Hot & Cold).
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. (Cold).
American Tube & Stamping Plant (Stanley Wks.) Bridgeport, Conn. (Hot & Cold.)
Athenia Steel Co., 135 William, New York, N. Y. (Cold.)
Barnes Co., Wallace, Bristol, Conn. (Hot.)
Central Alloy Steel Corp., Massillon, O. (Hot.)
Griffin Mfg. Co., Erie, Pa. (Hot & Cold.)
Laclede Steel Co., 8th & Olive Sts., St. Louis, Mo. (Hot.)
Latrobe Electric Steel Co., Latrobe, Pa. (Hot & Cold.)
Republic Iron & Steel Co., 335 Market, Youngstown, O
Sharon Steel Hoop Co., Sharon, Pa. (Hot.)
Stanley Wks., New Britain, Conn. (Hot & Cold.)
Steel and Tubes, Inc., Cleveland, O. (Hot & Cold.)
Superior Steel Corp., Union Trust Bldg., Pittsburgh, Pa. (Hot & Cold.)
West Leechburg Steel Co., Farmers Bank Bldg., Pittsburgh, Pa. (Hot & Cold.)

STRIPPERS, Wire

Acme. See A. Laubscher.
Artos Engineering Co., 69 Wisconsin, Milwaukee, Wis. (Cutting, Stripping and Measuring).
Austin Co., M. B., 108 S. Desplaines, Chicago, Ill.
Dicke Tool Co., Downers Grove, Ill.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
E-Z. See Pyramid Products Co.
F. F. See France Mfg. Co.
Foley Saw Tool Co., 655 Foley Bldg., 9 Main, N. E., Minneapolis, Minn. (Bench Type Wire Stripper.)
France Mfg. Co., 10325 Berea Rd., Cleveland. (Motor Driven.)
Goehst. See Klein & Sons.
Hartman. See Service Sales & Mfg. Co.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill
Ives Mfg. Co., Meriden, Conn.
Klein & Sons, Mathias, Chicago, Ill.
Laubscher, A., 77 Fort Pleasant Ave., Springfield, Mass.
Perfection. See Weber Machine Corp.
Service Sales & Mfg. Co., 17005 Melgrave Ave., Cleveland, Ohio.
Speedcraft. See Wire Stripper Co.
Weber Machine Corp., 33 S. Water, Rochester, N. Y.
Wire Stripper Co., 507 Erie Bldg., Cleveland, O.
Zierick Machine Wks., F. R., 6 Howard, New York City. (Motor Driven Stripper & Twister).

SWITCHBOARD INSTRUMENTS. See Instruments, Portable and Switchboard.

SWITCHBOARD OPALS. See Lenses.

SWITCHBOARDS, SLABS AND BARRIERS
See Asbestos Slabs; Molded Insulation: Slate; Soapstone.

SWITCH (Switches)
Arms. See Posts, Binding.
"Across the Line" Type. See Controllers, Motor.
Baby Knife. See Switches, Battery.
Battery. See Switches, Battery.
Canopy. See Switches, Snap.
Clock Operated. See Switches, Time.
Feed Through. See Switches, Snap.
Fixture. See Switches, Snap.
Float. See Switches, Tank.
Flush. See Switches, Snap.
Handles. See Handles, Wood
Knife, Baby. See Switches, Battery & Baby Knife.
Lever Radio. See Radio Mounting.
Lever. See Switches, Snap, Lever.
Limit. See Controllers, Motor.
Mercury. See Switches, Mercury
Motor Starting. Magnetic Type. See Controllers.
Motor Starting. Non-Magnetic. See Switches. Motor Starting.
Pendant. See Switches, Snap.
Pressure Regulating. See Controllers.
Push Button, Snap. See Switches, Snap.
Push Button, Motor Starting. See Switches, Remote Control.
Radio Receiver. See Radio Mountings.
Range. See Switches Snap; Heavy Duty
Remote Control. See Switches, Remote Control.
Reversing. See Controllers.
Rotary. See Switches, Snap.
Safety. See Switches, Knife.
Snap. See Switches, Snap.
Starter Type. See Controllers.
Storage Battery. See Switches, Storage Battery
Surface. See Switches, Snap.
Tank. See Switches, Tank
Time. See Switches, Time.
Toggle. See Switches, Snap.
Tumbler. See Switches, Snap.

SWITCHES, Battery and Baby Knife Cut-Out Switches.

Anti-Wood. See Kell & Son, Francis.
Bridgeport Switch Co., 209 Center, Bridgeport, Conn
Bryant Electric Co., Bridgeport, Conn.
Chapman. See Frank W. Morse & Co.
Chicago Elec. Mfg. Co., 2801 S. Halsted, Chicago, Ill.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Crown. See Edwards & Co., Inc
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Edwards & Co., Inc., 140th St. & Exterior, New York, N. Y.
Electrad, Inc., 428 Broadway, New York, N. Y.
Eureka. See Frank W. Morse & Co.
Fahnestock Elec. Co., cor. East Aves. and 8th, Long Island City, N. Y.
Handy. See Chicago Elec. Mfg. Co.
H. & H. See Hart & Hegeman Div.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co. Hartford, Conn. (Push Button.)
Harwood. See Frank W. Morse & Co.
Heinemann Elec. Co., Philadelphia, Pa.
Jost. See Frank W. Morse & Co.
Kappa. See Trumbull Elec. Mfg. Co.
Kell & Son, Francis, 401 E. 163rd, New York, N. Y.
Kendrick & Davis Co., Lebanon, N. H.
Keystone. See Frank W. Morse & Co.
King Mfg. Co., B. C., 302 Park Ave., Brooklyn, N. Y.
Knox Porcelain Corp., Knoxville, Tenn.
K-P-F Elec. Co., 855 Howard St., San Francisco, Cal.
Kurz & Root, Appleton, Wis.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Lyons Mfg. Co. (Mt. Carmel), New Haven, Conn.
Majestic Elec. Mfg. Co., 80 N. 12th St., St. Louis, Mo.
Manhattan Electl Supply Co., 190 Sixth Ave., New York.
Morse Co., Frank W., Boston, Mass.
Partrick & Wilkins Co., Philadelphia, Pa.
Porcelain Products, Inc., Findlay, Ohio.
Powerlite Switchboard Mfg. Co., 4149 E. 79th, Cleveland, O.
Pullrite. See Frank W. Morse & Co.
Reliable Electric Co., 3145 Carroll Ave., Chicago, Ill.
Samson Electric Co., Canton, Mass.
Spero Elec. Mfg. Co., E. 33rd and Woodland Ave., Cleveland
Sta-Rite. See Frank W. Morse & Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
Wood Elec. Co., C. D., 565 Broadway, New York, N. Y.

SWITCHES, Mercury

(For Temperature Control Apparatus.)
Con-Tac-Tor. See Time-O-Stat Controls Co.
Cooper Hewitt Electric Co., 410 Eighth, Hoboken, N. J.
Cramblet Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Febrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
General Kontroler Co., 200 E. First, Dayton, O.
Kon-nec-tor. See Cooper Hewitt Elec. Co.
Kontax. See General Kontroler Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Safety Regulator Co., 529 S. Mathews, Los Angeles, Cal.
Time-O-Stat Controls Co., Elkhart, Ind.

SWITCHES, Motor Starting

Accessible. See Trumbull-Vanderpoel Elec. Mfg. Co.
Aces. See Colt's Patent Fire Arms Mfg. Co.
Adam Elec. Co., Frank, St. Louis, Mo.
Aurora Steel Products Co., Aurora, Ill.
Barber Elec. Mfg. Co., North Attleboro, Mass.
Bull Dog Electric Products Co., Detroit, Mich.
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Crouse-Hinds Co., Syracuse, N. Y.
E. W. See Trumbull Elec. Mfg. Co.
FA. See Adam Elec. Co., Frank.
F. A. Triumph. See Metropolitan Elec. Mfg. Co.
Federal Steel Products Co., 2 Ave. L., Newark, N. J.
Large-Dail Mfg. Co., 606 Cherry, Philadelphia, Pa.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lundy Co., E. A., Fulton Bldg., Pittsburgh.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Major. See Adam Elec. Co., Frank.
Mason. See Trumbull-Vanderpoel Elec. Mfg. Co.
Metropolitan Device Corp., 1250 Atlantic Ave., Brooklyn, N. Y.
Metropolitan Elec. Mfg. Co., Blvd. at 14th, Long Island City, N. Y.
Murray. See Metropolitan Device Corp.
Mutual. See Bull Dog Elec. Products Co.
Naro. See Metropolitan Elec. Mfg. Co.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Nublade. See Colt's Patent Fire Arms Mfg. Co.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Robbins & Myers, Inc., Springfield, O.
Safe-Lock. See Trumbull-Vanderpoel Elec. Mfg. Co.
Safelock. See Westinghouse Elec. & Mfg. Co.
Schmuckler & Sons, 2232 N. 28th, Philadelphia, Pa.
Square D Co., Detroit, Mich.
S. S. See Wadsworth Elec. Mfg. Co.
Tanner & Co., Wm. F., 511 Sharp, Baltimore, Md.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
T. V. Safelock. See Trumbull-Vanderpoel Elec.
Unisafti. See Metropolitan Device Corp.
Unit-Versal. See Bull Dog Elec. Products Co.
Universal Metal Box & Products Co.
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Westinghouse Elec. & Mfg. Co., Mansfield, O.

SWITCHES, Remote Control

Push Button, Magnetically Operated.
Adam Electric Co., Frank, St. Louis, Mo.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Automatic Switch Co., 154 Grand, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Cutler-Hammer, Inc., 1287 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Dunco. See Struthers Dunn, Inc.
General Electric Co., Section W-234, Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
H. P. See Palmer Elec. & Mfg. Co
Industrial Controller Div. of Square D Co., Milwaukee, Wis.
Kato Engr. Co., Mankato, Minn
Lincoln Elec. Co., Coit Rd. & Kirby Ave., Cleveland, O.
Major, F. A., System. See Adam Elec. Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Precise Mfg. Co., 254 Mill, Rochester, N. Y.
Protectoswitch. See Precise Mfg. Co.
R. C. O. C. See South Bend Current Controller Co.
Sauter. See Cramer & Co., R. W.
Signal Engineering & Mfg. Co., 146 W. 14th, New York.
South Bend Current Controller Co., South Bend, Ind.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Takamine Corp., 208 Rawson St., Long Island City, N. Y.
Teeple Co., L. R., 540 E. Ninth, Portland, Ore.
Triplock. See Monitor Controller Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

SWITCHES, Snap

	KEY
Feed Through	See p
Fixture (Canopy, Candelabra and Key Arm)	See F
Flush	See f
Lever, Toggle, Tumbler	See L
Pendant	See p
Push Button	See P
Rotary	See R
Surface	See s

See Also Switches, Snap; Heavy Duty.
Adam Electric Co., Frank, St. Louis, Mo. f . . . . . .
Anylite Elec. Co., Ft. Wayne, Ind. . . . . L .
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. . . f sp P R L F
Arrow Head. See Arrow Elec.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. . . . . f p P . . . F
Best. See United States Elec. Mfg. Corp.
Brascolite. See Guth & Co., Edwin.
Bremer Elec. Mfg. Co., 139 N. 7th, Philadelphia, Pa. . . . . f . . . . . .
Bridgeport Switch Co., 209 Center, Bridgeport, Conn. . . . . L F
Bryant Elec. Co., Bridgeport, Conn. . . . . f sp P R L F
B. S. Co. See Bridgeport Switch Co.
Carling Tool & Machine Co., 32 Union Place, Hartford, Conn. . . . . F
Circle F. Mfg. Co., Trenton, N. J. . . . . f . . P . . L F
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn. . . . . p P R L F
Crouse-Hinds Co., Syracuse, N. Y. . . . . L . .
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis. . . . . P . . . . L . .
Diamond H. See Hart Mfg. Co.
Dugle. See Bryant Elec. Co.
Economy Fuse Mfg. Co., 2717 Greenview Ave., Chicago, Ill. . . . . F
Gaynor Elec. Co., Bridgeport, Conn. . . . . f . . . . . L . .
General Elec. Co., Section W-234, Merchandise Dept., Bridgeport, Conn. . . . f sp P R L F
Glo-Guide. See Bryant Elec. Co.
Gold Star Push Switch. See Hart & Hegeman.
Guth & Co., Edwin, 2615 Washington Ave., St. Louis, Mo. . . . . F
Hart Mfg. Co., Hartford, Conn. . . . . f sp P R L . .
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co. (Door Bolt Control) f sp P R L F
Hart. See Hart & Hegeman.
H. & H. See Hart & Hegeman Mfg. Co.
Hubbell, Inc., Harvey, Bridgeport, Conn. . . sp . . . . L F
Jost. See Morse, Frank W.
Kell & Son, Francis, 401 E. 163rd, New York, N. Y. . . . . f . . P . . . . .
Leviton Mfg. Co., 226 Newell, Brooklyn . . . . . F
Leveller. See McGill Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind. . . . . f . . . . . L F
Marks Products Co., 80 N. Ninth, Brooklyn, N. Y. . . . . L F
Metropolitan Elec. Mfg. Co., Blvd at 14th St., Long Island City, N. Y. . . . . s . . R . . . .
Morse Co., Frank W., 291 Congress, Boston . . . P . . . . .
National. See Standard Elec. Mfg. Co.
New England. See Paulding, John L.
Nutmeg. See Hubbell, Harvey, Inc.
Operite. See Morse Co., Frank W.
Pass & Seymour, Solvay Sta., Syracuse, N. Y. . . . . f sp P . . L F
Paulding, John I. New Bedford, Mass. . . . f s P . . . . .
Pen Tap. See Beaver Mfg. Co.
Perkins. See Bryant Elec. Co.
Pilot Electric Mfg. Co., 323 Berry, Brooklyn, N. Y. . . . . L . .
Pilotoggle. See Pilot Elec. Mfg. Co.
Pullrite. See Morse, Frank W.
Rodale Mfg. Co., 209 Hudson, New York p . . . . . .
Sears, Henry D., 80 Boylston, Boston . . f sp P R L F
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa. . . . . P . . . . . .
Snapit. See Marks Products Co.
Spartan. See Bryant Elec. Co.
Standard Elec. Mfg. Co., 941 Wrightwood Ave., Chicago, Ill. . . . . f s P R L . .
Triple. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. f s P R L . .
Tumbolier. See Hart & Hegeman.
Twi-Lite. See McGill Mfg. Co.
United States Elec. Mfg. Corp., 222 W. 14th, New York, N. Y. . . . . f . . . . . .
Victor. See Kell & Son, Francis.
Weber. See Sears, Henry D.
Wirerite. See Morse, Frank W.
Yankee. See Bryant Elec. Co.

SWITCHES, Snap; Heavy Duty

Heavy duty rotary snap switches for Electric Range and Small Motor Control.
Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Bryant Electric Co., Bridgeport, Conn.
Diamond H. See Hart Mfg. Co.
Domestic Electric Co., 7723 St. Clair Ave., Cleveland, Ohio.
General Electric Co., Section W-234, Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.

SWITCHES, Storage Battery; Automatic Disconnecting

Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Penn Electric Switch Co., Des Moines, Ia.
Radioloc. See Cutler-Hammer Mfg. Co.

SWITCHES, Tank

Blackburn-Smith Corp., 25 W. 45th, New York, N. Y.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Electrical Repair Co., 240 W. 25th, New York, N. Y.
General Electric Co., Schenectady, N. Y.
Industrial Controller Div. of Square D Co., S. Pierce & Hanover Sts., Milwaukee, Wis.
Leader-Trahern Products Co., Decatur, Ill.
Ostrander Elec. Wks., W. R., 911 Atlantic Ave., Brooklyn.
Penn Elec. Switch Co., 20th & Walnut, Des Moines, Ia.
Sundh Elec. Co., Parkhurst St. at Ave. C, Newark, N. J.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SWITCHES, Time (Automatic Clock Operated Switches)

Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Astrachron. See Gem Engineering Co.
Automatic Elec. Heater Co., 1505 Race, Philadelphia, Pa.
Automatic Elec. Mfg. Co., Mankato, Minn.
Automatic Lighting Co., 831 Greenmount Ave., Baltimore
Automatic Sprinkler Corp. of America, 910 B. of L. E. Bank Bldg., Cleveland, Ohio.
Automatic Timer Co., 1341 Euclid Ave., Cleveland, O.
Berry, A. Hall, 73 Murray, New York, N. Y.
Brown & Pengilly, Inc., 1264 Folsom, San Francisco, Cal
Buckeye Time Switches, Inc., 1557 St. Clair Ave., Cleveland, O.
Cackle. See Berry A. Hall.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Clark. See Automatic Heater Co.
Con-tac-tor. See Absolute Con-tac-tor Corp.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Frisch, Walter P., 104 Linden, Rochester, N. Y.
Gem Engineering Co., Hempstead, N. Y.
General Electric Co., Schenectady, N. Y.
Go-N-Set. See G. & S. Research Lab.
G. & S. Research Laboratory, 1269 Cochran Ave., Los Angeles, Cal.
Hart Mfg. Co., Hartford, Conn.
Hartford. See Berry A. Hall.
Horni Signal Mfg. Co., 290 Hudson, New York, N. Y.

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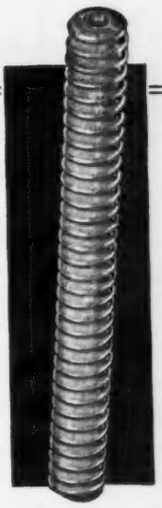

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THOMAS MADE porcelains not only promise but insure an unparalleled grade of insulation; *accuracy* that only skilled craftsmen accustomed to precision workmanship can produce; and *uniformity* that is the direct result of modern production facilities.

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Accurate - - - Good appearance
Reasonable Prices

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Akron, Ohio
Formerly the Mogadore Insulator Company

SWITCHES, Time—Continued
Jewel. See Time Switch Sales & Service.
Knowles, W. E., 2869 Broadway, Oakland, Cal.
Kwixset. See Thompson Clock Co.
Lamp-Lighter. See Robbins & Myers Co.
Liberty Bell Mfg. Co., Minerva, Ohio.
Mercury Time Switch Co., Marine City, Mich.
Northwestern Clock Co., Omaha, Neb.
Ohio Time Switch Co., 1439 St. Clair Ave., Cleveland.
Paragon Elec. Co., 409 S. Dearborn, Chicago, Ill.
Racine. See Reliance Automatic Ltg. Co.
Radio Owl, 2269 E. 51st, Los Angeles, Cal.
Radio Switchman. See R-V Mfg. Co.
Reliance Automatic Ltg. Co., 1925 Meade, Racine, Wis.
Research Mfg. Laboratory, 1269 Cochran Ave., Los Angeles.
Robbins & Myers Co., Springfield, O.
Ross Safety Switch Corp., 1 E. 42nd, New York, N. Y.
R-V Mfg. Co., Marshfield, Mass.
Sauter. See Cramer & Co.
States Co., Hartford, Conn.
Thompson Clock Co., H. C., Bristol, Conn.
Time Switch Sales & Service, 1841 Euclid Ave., Cleveland. O.
Tork Clocks, Inc., 12 E. 41st, New York, N. Y.
Waiser Automatic Timer Co., 342 Madison Ave., New York.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

TACHOMETERS

Speed Indicators, Speedometers, Revolution Counters.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne & Windrim, Philadelphia.
Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.
Durant Mfg. Co., 655 Buffum, Milwaukee, Wis.
Electric Tachometer Corp., Spring Garden & Broad St., Philadelphia, Pa.
Holtzer-Cabot Elec. Co., Boston, Mass.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa
Productimeter. See Durant Mfg. Co.
Standco. See Sticht & Co.
Sticht & Co., H. H., 13 Park Row, New York, N. Y.
Veeder Mfg. Co., 14 Sargeant, Hartford, Conn.
Weston Elecl. Instrument Co., 582 Freilinghuysen Ave., Newark, N. J.
Zernickow Co., O., 15 Park Row, New York, N. Y.

TAGS, Cable; Pole and Battery

American Radio Hardware Co., 135 Grand, New York, N. Y. (Battery Lead Tags.)
Benedict Mfg. Co., East Syracuse, N. Y.
Brocklin Underground Elec'l Mfg. Co., Glenside, Pa.
Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill.
Grammes & Sons, Inc., L. F., Allentown, Pa.
International Tag Co., 319 N. Whipple, Chicago, Ill.
Premax Products, Inc., Niagara Falls, N. Y.
Viking Tool & Machine Co., 745 65th, Brooklyn, N. Y.
Waterbury Button Co., Waterbury, Conn.

TAGS, Shipping

Campbell Paper Box Co., South Bend, Ind.
International Tag Co., 319 W. Whipple, Chicago, Ill
TAMPING TOOLS, COIL. See Tools, Commutator Truing.
TANK SWITCHES. See Switches, Tank.
TANKS, TINNING. See Wire Manufacturing Machines.

TAPE, Asbestos

American Asbestos Co., Norristown, Pa.
Asbestos Fibre Spinning Co., North Wales, Pa.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
General Asbestos & Rubber Co., Charleston, S. C.
Johns-Manville Corp., New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Niagrite. See Johns-Manville, Inc.
Shield Brand. See Mitchell-Rand Mfg. Co.

TAPE, Cotton, Linen, Silk; Tape, Sleeving, Webbing.

Alfalfa. See Burrell Belting Co.
Anchor Webbing Co., Nye, Pawtucket, R. I. (Cotton, Silk.)
Awebco. See Anchor Webbing Co.
Bermaline. See Burrell Belting Co.
Burrell Belting Co., 413 S. Hermitage Ave., Chicago, Ill.
Eagle. See Sidebotham, Inc., John.
General Electric Co., Schenectady, N. Y.
Gilmer Co., L. H. (Tacony), Philadelphia, Pa.
Hope Webbing Co., 1005 Main, Providence, R. I.
Krout & Fite Mfg. Co., Allegheny Ave. & Emerald Philadelphia, Pa.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sidebotham, Inc., John, 4317 Griscom, Philadelphia, Pa.
Smith Belting Co. (Germantown), Philadelphia, Pa.
Superfine. See Windsor Webbing Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Windsor Webbing Co., Pawtucket, R. I.
Worcester Braiding Co., 34 Southbridge, Worcester, Mass.

TAPE, Mica

Chicago Mica Co., 345 Campbell, Valparaiso, Ind.
Mica Insulator Co., 200 Varick, New York, N. Y
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TAPE, Rubber and Friction

Ackerman. See Ackurate Rubber Co.
Ackurate Rubber Co., 25 Beaver St., New York, N. Y.
Adamson & Co., Joseph, Columbia and Germantown Aves. Philadelphia, Pa.
Adhere. See Westinghouse Elec. & Mfg. Co.
Alpha. See Johns-Manville, Inc.
Amazon. See Graybar Elec. Co.
Appleton Rubber Co., Franklin, Mass.
Black Diamond. See Dunton Co., M. W.
Boston Woven Hose & Rubber Co., Boston, Mass.
Brooklyn. See Johns-Manville, Inc.
Bull-Dog. See Boston Woven Hose & Rubber Co.
Candee. See Ackurate Rubber Co.
Canfield Rubber Co., Bridgeport, Conn.
Canton. See Plymouth Rubber Co.
Clifton. See Clifton Mfg. Co.
Clifton Mfg. Co., 65 Brookside Ave., Boston 30, Mass.
Competition. See New York Insulated Wire Co.
Double-Wear. See Dryden Rubber Co.
Dryden Rubber Co., 1014 S. Kildare Ave., Chicago, Ill.
Dunsee, A. & B. See Okenite Co.
Dunton Co., M. W., 670 Eddy St., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Elkhart Rubber Wks., Elkhart, Ind.
Firestone Tire & Rubber Co., Akron, O.
General Electric Co., Section W-234, Merchandise Dept., Bridgeport, Conn.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y.
Grimshaw. See New York Insulated Wire Co.
Grintite. See Canfield Rubber Co.
Holfast Rubber Co., Atlanta, Ga.
Holdtite. See United States Rubber Co.
Hydro-Proof. See Elkhart Rubber Wks.
Imperial Rubber Co., 220 Broadway, New York N. Y.
Imperv. See Canfield Rubber Co.
Ireo. See Imperial Rubber Co.
Johns-Manville Corp., New York, N. Y.
Jomaneo. See Johns-Manville, Inc.
Kerite Ins. Wire & Cable Co., 30 Church, New York, N. Y.

Manson. See Okonite Co.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
New York Insulated Wire Co., 114 Liberty, New York, N. Y.
Okonite Co., Passaic, N. J.
O. K. See Appleton Rubber Co.
P. & B. See Ruberoid Co.
Paratex. See Appleton Rubber Co.
Paruco. See Passaic Rubber Co.
Passaic Rubber Co., Clifton, N. J.
Plymouth Rubber Co., 1400 Revere, Canton, Mass.
Red-X. St. Louis Rubber Cement Co.
Relio. See United States Rubber Co.
Ruberoid Co., 95 Madison Ave., New York, N. Y.
S. I. See Superior Insulating Tape Co.
Sitco. See Superior Insulation Tape Co.
Slipknot. See Plymouth Rubber Co.
Star. See Sullivan & Sons Mfg. Co., J.
Sticka. See Graybar Elec. Co.
Stixwell. See Clifton Mfg. Co.
Sullivan & Sons Mfg. Co., J., 2224 N. 9th, Philadelphia, Pa.
Superior Insulating Tape Co., 3044 Lambdin Ave., St. Louis.
2-Plex. See Holfast Rubber Co.
U. S. See United States Rubber Co.
United States Rubber Co., 1790 Broadway, New York, N. Y.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago.
Victor. See Graybar Elec. Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa

TAPE, Varnished Fabric

Acme Wire Co., New Haven, Conn.
General Electric Co., Section W-234, Merchandise Dept., Bridgeport, Conn.
Irvington Varnish & Insulator Co., Irvington, N. J.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
New Jersey Wood Finishing Co., Woodbridge, N. J.
Radiotape. See Respro, Inc.
Respro, Inc., Wellington Ave. (Auburn), Providence, R. I.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sico. See Standard Insulator Co.
Standard Insulation Co., East Rutherford, N. J.
Voltape. See Respro, Inc.

TAPING MACHINES, Coil

Chapman Electric Works, P. E., 1820 Chouteau Ave., St Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Griswold Machine Co., George, New Haven, Conn.
Ridion Company, Frank, Boston, Mass.
Segur. See Electric Service Supplies Co.

TAPING MACHINES, Wire

American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Wire Machinery Corp. of Am., New Haven, Conn.
TAPS. See Stocks, Dies and Reamers.
TENSION DEVICES, Coil Wire. See Racks, Wire Reel

TENSION MACHINES, Band Wire

Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.

TERMINALS AND CONNECTORS

Low Tension, Secondary Terminals and Connectors.
All-in-One. See Ohio Parts Co.
Barry-Nicholson Co., 2901 Fort, W., Detroit, Mich.
Bassett Metal Goods Co., Derby, Conn. (General Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Burton-Rogers Co., Boston, Mass.
Cabelug. See Jones, Howard B.
Clark Metal Products, 490 Hancock Ave., Bridgeport.
Dixie Supply Co., 91 7th Ave., New York.
Double Grip. See Pons, Eugene
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electron. See Bassett Metal Goods Co.
Fahnestock Elec. Co., East Ave. and 8th, Long Island City, N. Y.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Ideal Clamp Mfg. Co., 198 Bradford, Brooklyn, N. Y.
Jones, Howard B., 2226 Wabansia, Chicago, Ill.
K. E. M. See Kuller Elec. Mfg. Co.
Kuller Elec. Mfg. Co. 575 Pierce Ave., Long Island City.
Morse Co., Frank W., Boston, Mass.
Nu-Way Snap. See Hatheway Mfg. Co.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati, O.
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa.
Patton-MacGuyer Co., Providence, R. I.
Pons, Eugene, 927 Campbell Ave., Schenectady, N. Y
Peterson Co., 7 Beverly, Providence, R. I.
Rajah Co., Bloomfield, N. J.
Salem Elec'l Supply Co., Salem, Mass.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Shure. See Burton-Rogers Co.
Tinkerbox. See Weber Elec. Wks.
Waterbury, Button Co., Waterbury, Conn.
Weber Elec. Wks., Brooklyn Sts., Cleveland, O.
Wolverine Tube Co., 1415 Central Ave., Detroit, Mich.
Zierick Machine Wks., F. R., 6 Howard, New York.

TEST BENCHES, Armature

Allen Electric & Equipment Co., Kalamazoo, Michigan.
Burton & Rogers Co., Boston, Mass.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind
Hobart Bros. Co., Troy, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Mibo Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Pence & Son, H. O., San Luis Obispo, Cal.
Weidenhoff, Joseph, 4352 W. Roosevelt Road, Chicago, Ill
TESTING INSTRUMENTS. See Instruments.

TESTERS, Coil

(Includes Armature Growlers, trouble shooters, and other portable testing devices). See also Instruments
Arc. See Weidenhoff, Joseph.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Ankenbrandt, J. J., 2140 Wakeman, Toledo, Ohio.
Armeter. See Chapman Electric Works, P. E.
Bartlett Electric Products Co., Goshen, Ind. (Storage Battery).
Batt-O-Meter. See Indiana Mfg. & Elec. Co., also Case Elec.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
Case Elec. Co., Marion, Ind.
Century Electrical Co., 102 Randall Ave., Syracuse, N. Y.
Chapman Elec'l Works, P. E., 1820 Chouteau Ave., St. Louis. Mo

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Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Columbia. See Weidenhoff, Joseph.
Comparometer Co., New Ulm, Minn.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Economy. See Weidenhoff, Joseph.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Electrotest. See Comparometer Company.
Elmco. See Electric Machine Corp.
Ev-Ri-Test. See Weidenhoff, Joseph.
Ga-Jit. See General Instrument Corp.
General Instrument Corp., 225 Varick, New York, N. Y.
Herald Elec. Co., 29 East End Ave., New York, N. Y.
Hobart Bros. Co., Troy, Ohio.
Ideal. See Ankenbrandt, J. J.
Indiana Mfg. & Electric Co., Marion, Indiana.
Kietzman Electrical Mfg. Co., 234 N. Central, Gilman, Ill.
Leich Electric Co., Genoa, Ill.
Lundin Electric Machine Co., 10 Thacher, Boston, Mass.
Mallory Electric Co., Factories Bldg., Toledo, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Mibo Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Paneltest. See Allen Elec. & Equip. Co.
Portometer. See Allen Elec. & Equip. Co.
Portostat. See Allen Elec. & Equip. Co.
Preato. See Metal Specialties Mfg. Co.
Reliable Parts Mfg. Co., Wellington, Ohio.
Rex Batrystat. See Bartlett Products Co.
Scout. See Leich Electric Company.
Servwell Sales Corp., 1749 N. Winchester Ave., Chicago, Ill.
Test-All. See Colpin Corp.
Test-O-Meter. See Weidenhoff, Joseph.
Test-Rite. See Colpin Corp.
Victory. See Weidenhoff, Joseph.
Weidenhoff, Joseph. 4352 W. Roosevelt Rd., Chicago, Ill.

TESTING LABORATORIES

Elec'l Testing Laboratories, 80th St. and East End Ave., New York, N. Y.
National Elec'l Inst. Co., 162 Sidney, Cambridge, Mass.
New York Testing Laboratories, 80 Washington, New York.
Rubicon Co., 29 N. Sixth, Philadelphia, Pa.
Stupakoff Laboratories, 6617 Hamilton Ave., Pittsburgh, Pa.
THERMO JUNCTIONS. See Instruments, Laboratory Standard.

THERMOSTATIC METAL

Chace Valve Co., W. M., 1600 Beard Ave., Detroit, Mich.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I.
Improved Seamless Wire Co., 775 Eddy, Providence, R. I.
Interstate Products Corp., 29 Commercial, Newark, N. J.
Venbur. See Coffin Mfg. Co., B. F.
Wilco. See H. A Wilson Co
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

THERMOSTATS

American Thermostat Co., 226 Jeliff Ave., Newark, N. J.
Automatic Appliance Co., Jackson, Mich.
Bak-Rite. See Electric Appliance Mfg. Co.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Boston Machine Wks. Co., 7 Willow, Lynn, Mass.
Brown. See Electric Automatic Appliance Co.
Brown Instrument Co., Wayne & Windrim, Philadelphia, Pa.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Cobb Elec. Appliance Co., 100 Massachusetts Ave., Boston,
Cramblett Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Diamond H. See Hart Mfg. Co.
Electric Automatic Appliance Co., Denver, Colo.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland, O.
Electric Maid. See Hankscraft Co.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Freas Thermo-Electric Co., 1206 S. Grove, Irvington, N. J.
Globe Mfg. Co., Battle Creek, Mich.
Hankscraft Co., 815 E. Washington, Madison, Wis.
Hart Mfg. Co., Hartford, Conn.
Hi-Lo. See Boston Machine Wks. Co.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Interstate Products Corp., 29 Commercial, Newark, N. J.
King. See Electric Heat Control Co.
Manhattan Elecl. Supply Co., 190 Sixth Ave., New York.
Marvel. See American Thermostat Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Moeller, A. E., 261 Sumpter, Brooklyn, N. Y.
Midget. See Coffin Mfg. Co., B. F.
National Steel Construction Co., 425 Fountanas, Seattle, Wash.
Pyratherm. See Federal Gauge Co.
Safety Regulator Co., 529 S. Mathews, Los Angeles, Cal.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Standard Thermometer Co., 65 Shirley, Boston 19, Mass.
Tagliabue Mfg. Co., C. J., 18 33rd, Brooklyn, N. Y.
Teeple Co., L. B., 540 E. 9th, Portland, Ore.
Thermolectric. See Bishop & Babcock Sales Co.
Thermosnap. See Spencer Thermostat Co.
Time-O-Stat Controls Co., Elkhart, Ind.
Trent Co., Harold E., 439 N. 12th, Philadelphia, Pa.
Visaflame. See Mercoid Corp.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wilcolator Co., 17 Nevada, Newark, N. J.

TIGHTENERS, Commutator

Elmes Engineering Works, Chas. F., 222 N. Morgan, Chicago, Ill.
TIME SWITCHES. See Switches, Time.
TINNING TANKS, WIRE. See Wire Manufacturing Machines.
TINSEL. See Wire, Insulated.

TIPS, Cord

Duro. See McEvoy, C. H.
McEvoy, C. H., 430 Broadway, Lowell, Mass.
National Acme Mfg. Co., 7500 Stanton Ave., Cleveland, O.
Norden & Co., S. 180 S. Water, Providence, R. I.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y.
Waterbury Brass Goods Corp., Waterbury, Conn.
TOOLS, Commutator Slotting. See Slotting Machines & Tools, Commutator.

TOOLS, Coil Tamping

Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.

TOOLS, Commutator Truing

Acme. See Green Equipment Corp.
Allen Elec. & Equipment Co., N. Pitcher St., Kalamazoo, Mich.
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Central Mfg. Co., Fairfield, Ia.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Imperial. See Martindale Elec. Co.
Jordan Bros., 74 Beekman, New York, N. Y.
Martindale Elec. Co., 1255 W. Fourth, Cleveland, Ohio.

TOOLS, Storage Battery

Battery Euipment & Supply Co., 7530 Greenwood Ave., Chicago, Ill. Burning Racks, Battery Trucks, Plate Pressers, Mallets, Lead Burners and Strainers.

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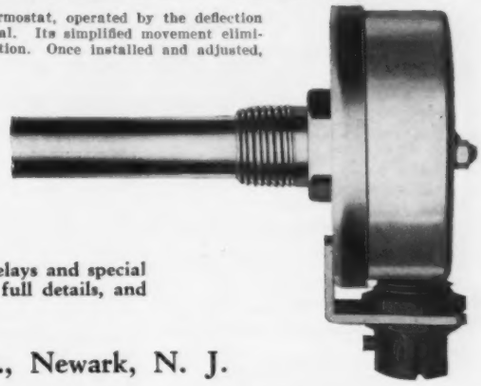

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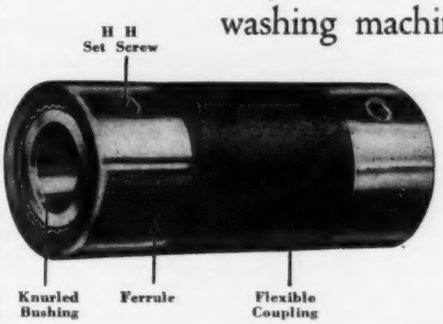

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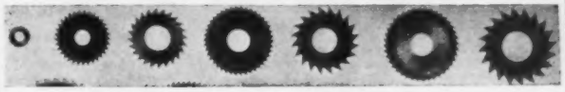

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Battery Tools Co., 29 Willow, Montclair, N. J.
Besco. See Battery Equipment & Supply Co.
Bobbett Elec. Mfg. Co., 811 E. 43rd St., Chicago, Ill. (Knife Heaters.)
Canedy-Otto Mfg. Co., 1816 McGee, Chicago Heights, Ill. (Floor Vises.)
General Elec. Co., Schenectady, N. Y. (Lead Burning Outfits.)
Heet-A-Knife. See Op-al Elec. & Mfg. Co.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati. (Terminals.)
Op-al Elec. & Mfg. Co., 1057 E. 30th St., Indianapolis, Ind. (Knife Heaters.)
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa. (Pillar Post Sleeves, Tongs, Reamers, Strap Punches, Terminal Pullers, Steamers, Racks or Stands, Terminal Post Shapers, Battery Analyzer, Post Sealing Machine, Plate Burning Press, Press and Stands.)
Pyratip. See General Elec. Co.
Reliable Parts Mfg. Co., Wellington, O. (Steamer and Still, Filler, Separator Cutter, Clips, Carrier, Post Cutter, Terminal and Cell Puller.)
Thompson Mfg. Co., Meadville, Pa. (Reamers, Terminal Post Pullers, Pressing Tongs.)

TORCHES AND FURNACES
Acetylene, Alcohol, Gasoline, Kerosene.
Bernz Co., Otto, Newark, N. J.
Clayton & Lambert Mfg. Co., Detroit, Mich.
Dreadnaught. See Wall Mfg. Supply Co.
Klein & Sons, Mathias, Chicago, Ill.
Lasher-Peerblow Co., 237 Harrison Ave., Boston, Mass.
McGill Mfg. Co., Valparaiso, Ind.
Peerless. See Lasher-Peerblow Co.
Staysalite. See Klein & Sons, Mathias.

TORPEDO Cord. See Twine.

TORSION BALANCES. See Instruments, Laboratory Standard

TRANSFORMERS
Radio. See Radio Circuit Components.
Gas Tube Sign. See Transformers, Oil Burner.
Oil Burner Ignition. See Transformers, Low & Intermediate Voltage.

TRANSFORMERS, Low and Intermediate Voltage
For Oil Burners, Gas Tube Signs, and other special purposes.
American Bosch Magneto Corp., Springfield, Mass.
American Transformer Co., Newark, N. J.
Campbell Elec. Mfg. Co., Lynn, Mass.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
General Electric Co. (Merchandise Dept.), Bridgeport, Conn.
Manhattan Elect. Supply Co., 199 Sixth Ave., New York.
Sorgel Electric Co., 89 W. Water, Milwaukee, Wis.
Standard Transformer Co., Warren, O.
Thordarson Elec. Mfg. Co., Huron & Kingsbury Sts., Chicago, Ill.
Uptigraff Mfg. Co., R. E., First National Bank Bldg., Pittsburgh, Pa.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
Webster Electric Co., Racine, Wis.

TRANSMISSION DRIVES. See Chain, Transmission.

TRANSMITTERS, Power
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Segur. See Electric Service Supplies Co.

TROUBLE FINDERS. See Instruments, Portable and Switchboard; also Testers, Coil.

TRUCKS, Armature. See Lifts, Armature.

TRUCKS, Factory Steel
Angle Steel Stool Co., Plainwell, Mich.

TRUING Devices, Commutator. See Tools, Commutator.

TUBE (Tubes) (Tubing) Adapters. See Radio Receiver Parts
Brass. See Tubing, Brass.
Condenser. See Tubing, Brass and Copper
Copper. See Tubing, Brass.
Cutters. See Stocks, Dies, etc.
Fibre. See Fibre.
Fibre Candle. See Candles.
Mica. See Mica.
Paper. See Tubes, Paper.
Platinum. See Platinum.
Pyrometer. See Cores, Resistance.
Refractory. See Cores, Resistance.
Radio. See Radio Vacuum Tubes.
Varnished Fabric. See Tubing, Varnished Fabric.

TUBES, Paper; Cores; Sleeves, Bushings
Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Climax Tube Co., Mystic, Conn.
Klimaxcore. See Climax Tube Co.
McCausland, J. E., 86 Valley, Providence, R. I.
Fairpoint Corp., New Bedford, Mass.
Reliable Elec. Co., 3145 Carroll Ave., Chicago, Ill.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa.
Stone Paper Tube Co., 38 O. N. E., Washington, D. C.
Textile Tube Co., Fall River, Mass. (Paper Sleeves.)

TUBING, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co.
Baltimore Tube Co., Baltimore, Md.
Bridgeport Brass Co., Bridgeport, Conn.
Bull Dog. See National Elec. Products Corp.
Chase Brass & Copper Co., Waterbury, Conn.
Conklin Brass & Copper Co., T. E., 54 Lafayette, New York.
Cook, Dunbar Smith Co., 85 Sprague, Providence, R. I.
Dallas Brass & Copper Co., 820 Orleans, Chicago, Ill.
French Mfg. Co., 128 Robbins, Waterbury, Conn.
Mueller Brass Co., Port Huron, Mich.

National Copper & Smelting Co., 1395 Coltman Rd., Cleveland, O.
National Electric Products Corp., Pittsburgh, Pa.
Randolph Clowes Co., Waterbury, Conn.
Reileum. See Mueller Brass Co.
Roberts Tube Works, 2500 Military Ave., Detroit, Mich.
Rome Brass & Copper Co., Rome, N. Y.
Rome Hollow Wire & Tube Co., Rome, N. Y.
Rome Turney Radiator Co., Rome, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Standard Underground Cable Co. (Div. of General Cable Corp.), Pittsburgh, Pa.
Summerill Tubing Co., Bridgeport, Pa.
Torrington Mfg. Co., Torrington, Conn.
United Wire & Supply Co., 1497 Elmwood Ave., Providence.
Wells Co., A. H., Watertown Ave., Waterbury, Conn.
Wolverine Tube Co., 1415 Central Ave., Detroit, Mich.

TUBING, Flexible Metallic
(Flexible Tubing.)
Almond Mfg. Co., T. R., Ashburnham, Mass.
American Metal Moulding Co., 146 Colt St., Irvington, N. J.
Auto-Brassflex. See National Metal Molding Co.
Auto-Steelflex. See National Metal Molding Co.
Breeze Corp., Inc., 24 S. 6th, Newark, N. J.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
National Elec. Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa.
Riflex. See United Metal Hose Co.
Sleeper & Hartley, Inc., Worcester, Mass.
Time-O-Stat Controls Co., Elkhart, Ind.
Titeflex Metal Hose Co., Newark, N. J.
Triangle Conduit Co., Dry Harbor Rd. and Cooper Ave., Brooklyn, N. Y.
United Metal Hose Co., 724 Garrison Ave., New York, N. Y.
White Dental Mfg. Co., S. S., 152 W. 42nd, New York.

TUBING, Rubber
Rubber Tubing for Insulating Wire in Instruments and Telegraph Signal Lines.
Canfield Rubber Co., 702 Railroad Ave., Bridgeport, Conn.
Faultless Rubber Co., Ashland, O.
Forest City Rubber Co., 1276 Ontario, Cleveland, O.
Goodrich Rubber Co., B. F., Akron, O.
Tyler Rubber Co., Andover, Mass.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N. Y.

TUBING, Varnished Fabric
Insulating Tubing—Spaghetti.
Acme Wire Co., New Haven, Conn.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y.
Bentley-Harris Mfg. Co., Conshohocken, Pa.
Brand & Co., William, 268 Fourth Ave., New York, N. Y.
Empire. See Mica Insulator Co.
General Electric Co., Section W-234, Merchandise Dept., Bridgeport, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Insulated Duct & Cable Co., Stokes, Trenton, N. J.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
Irvington Varnish & Insulator Co., Irvington, N. J.
Lee Tire & Rubber Co., Conshohocken, Pa.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky. (Insulated Waxed Cotton.)
Turbo. See Brand & Co.
Varflex Corp., Rome, N. Y.

TURNED-UP BOXES AND CABINETS. See Cabinets, Sheet Steel.

TURNING TOOLS, COMMUTATOR. See Tools, Commutator Truing.

TWINE, Armature Winding; Torpedo Cord
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Winne & Son, Frank W., 42 N. Front, Philadelphia, Pa.

UNDERCUTTERS, Mica. See Slotting Machines & Tools Commutator.

UNITS, Refrigerator Condenser. See Condenser Units, Refrigerator

UNITS, Rods and Grids, Resistance
Acme Elec. Heating Co., Dept. R, 1217 Washington, Boston.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Automatic Electric Heater Co., 1706 Race, Philadelphia, Pa.
Bradleyunit. See Allen Bradley Co.
Buffalo Products Co., Jamoome & Lafayette Sts., New York.
Burger, J. P., 1813 Columbus Rd., Cleveland, O.
Calrod. See Edison Elec. Appliance Co.
Carter Radio Co., 2422 Prospect Ave., Chicago, Ill.
Chromalax. See Edwin L. Wiegand Co.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Crown Coloring & Chemical Co., 33 W. 17th, New York.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Dalton Elec. Heating Co., 287 Bridge St., Salem, Mass.
Dalton-Marsh Co., 88 Holten, Danvers, Mass.
Daric Co., 35 E. 21st, New York, N. Y.
Di-El-Ite. See Wirt Co.
Dixon Crucible Co., Jos., Jersey City, N. J.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Edgerst. See Industrial Controller Div.
Edgewound. See Monitor Controller Co.
Edison Electric Appliance Co., 5600 W. Taylor, Chicago, Ill.
Elec. Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.
Electro Thermal-Unit Co., 44 N. Fourth, Philadelphia, Pa.
Elemite. See Louthan Mfg. Co.
Fits-All. See Eagle Elec. Mfg. Co.
Fitz-All. See Rodale Mfg. Co.
Fitz-Rite. See Rodale Mfg. Co.

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Fix-All. See Witlow Elec. Mfg. Co.
F & M. See Hiram Marks Elec. Co.
General Electric Co., Schenectady, N. Y.
Globar Corp., Niagara Falls, N. Y.
Glo-Well. See Eagle Elec. Mfg. Co.
Gold Seal Elecl. Co. of Ohio, Inc., 250 Park Ave., New York, N. Y.
Hance-Parker Mfg. Co., Meriden, Conn.
Hankscraft Co., 615 E. Washington, Madison, Wis. (Oven Heater Unit.)
Hardwick, Hindle, Inc., 122 Greenwich, New York, N. Y.
Hexwound. See Monitor Controller Co.
Industrial Controller Div. of Square D Co., S. Pierce & Hanover Sts., Milwaukee, Wis.
Industrial Heater Co., 300 Canal, New York, N. Y.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa. (Radio Resistance.)
Krischer's Mfg. Co., 255 Calyer, Brooklyn.
Louthan Mfg. Co., East Liverpool, O.
Marks, Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich.
Monitor Edgewound. See Clark Controller Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
Nelco. See Nelson Electric Co.
Nelson Electric Co., Plant City, Fla.
Northern Electric Co., 2833 N. Western Ave., Chicago, Ill.
Ogden Mfg. Co., 3947 Armitage Ave., Chicago, Ill.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill.
Ohm-Spun. See States Co.
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Poloron Elec. Mfg. Co., 20 Bond, New York, N. Y.
Presto Products Co., 64 University Place, New York, N. Y.
Prometheus Elec. Corp., 358 W. 13th, New York, N. Y.
Pyrox. See Westinghouse Elec. & Mfg. Co.
Reben Elec. Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Remco. See Reben Elec. Mfg. Co.
Renuall. See Ogden Mfg. Co.
Repairall. See Waage Elec. Co.
Replaceall. See Waage Elec. Co.
Resistance Laboratories, Inc., 20 W. 22nd, New York, N. Y.
Ribohm. See Ward Leonard Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Security Elec. Mfg. Co., 2633 Canton St., Chicago, Ill.
Senco. See Automatic Electric Heater Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa.
Smoothwound. See Monitor Controller Co.
Snoco. See Snow & Co.
Snow & Co., E. W., Rochester, N. Y.
Super. See Northern Elec. Co.
United Metal Art Mfg. Co., 293 Wyckoff Ave., Brooklyn, N. Y.
Vitrohm. See Ward Leonard Elec. Co.
Waage Elec. Co., 5100 W. Ravenswood Ave., Chicago
Ward Leonard Elec. Co., 31 South, Mt. Vernon, N. Y.
Warren Elec. Appliance Co., Warren, Pa.
Watlow Elec. Mfg. Co., 1320 N. 23rd, St. Louis, Mo.
Westinghouse Elec. & Mfg Co., Mansfield, O.
Wiegand Co., Edwin L., 421 First Ave., Pittsburgh, Pa.
Wirt Co., 5221 Greene, Philadelphia, Pa.

VACUUM CLEANER BAGS. See Bags, Vacuum Cleaner

VACUUM DRYING & IMPREGNATING OVENS. See Ovens, Industrial.

VACUUM PUMPS. See Pumps, Vacuum.

VALVES, Electrically Operated
Asco. See Automatic Switch Co.
Automatic Switch Co., 154 Grand, New York.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., ft. of Tolman, Boston, Mass. (Water.)
Crane Co., S. Michigan Ave., Chicago, Ill.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
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Electric-Valve Mfg. Co., 68 Murray, New York, N. Y.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Gas-Gard Co., 375 Main St., E., Rochester, N. Y. (Gas.)
General Electric Co., Schenectady, N. Y.
Golden-Anderson Valve Specialty Co., 1385 Fulton Bldg., Pittsburgh, Pa.
Lunkenheimer Co., Cincinnati, O.
Minneapolis-Honeywell Regulator Co., Fourth Ave. & 28th, Minneapolis, Minn.
Nacco Mfg. Co., 1482 Clara Ave., St. Louis, Mo.
Northside Elec. Co., 4227 Spring Grove Ave., Cincinnati, O.
Protect-U. See Ziach Engineering Corp.
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Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
St. Louis Motor Valve Co., St. Louis, Mo.
Tagliabue Mfg. Co., C. J., 18-83rd St., Brooklyn, N. Y.
Terple Co., L. R., 540 E. Ninth, Portland, Ore. (Gas.)
Time-O-Stat Controls Co., Elkhart, Ind.
Victor. See Lunkenheimer Co.
Ziach Engineering Corp., 39 Avenue L, Newark, N. J. (Gas.)

VARNISH. See Paint, Varnish, Lacquer.

VARNISHED TAPE. See Tape, Varnished Fabric.

VARNISHED TUBING. See Tubing, Varnished Fabric.

VOLT BOXES. See Instruments, Laboratory Standard.

VOLTMETERS. See Instruments.

VULCANITE. See Rubber, Hard.

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Wax and Compound, Sealing and Filling.....See W
Junction Box, Potheads, Battery Tops, Bolt Head Holes.
Wax and Compound.....See S
Saturating and Finishing, Braided Wire, Impregnating Fabric and Paper.
Chatterton's Compound.....See C
Ackurate Rubber Co., 25 Beaver, New York, N. Y. W . . . .
Ajax. See Sherwin-Williams Co.
Asphalt Products Co., 6531 S. State, Chicago. . . . S . .
Bishop Wire & Cable Corp., 420 E. 25th, New York, N. Y. C
Biwax Corp., 208 S. La Salle, Chicago, Ill.... W S . .
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Bulls-Eye. See Zinsser & Co.
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Clifton Mfg. Co., 65 Brookside Ave., Boston.... . . . C
Coehrane Chemical Co., 432 Danforth Ave., Jersey City, N. J. . . . . W S . .
Dolph Co., John C., 168 Emmet, Newark, N. J. W . . . .
Di Electric Puttie. See Ackurate Rubber Co.
Ever-Protect. See National Cable Compound Co.
Flake White. See Williams Co., F. M.
General Electric Co., Section W-234, Merchandise Dept., Bridgeport, Conn. . . . . W . . . .
Geoge Co., P. A., 4153 Bingham Ave., St. Louis. W . . . .
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Goldo Brown. See Williams Co., F. M.
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Hansen. See Northwestern Mfg. Co.
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Zeus. See Gibb Welding Machine Co.
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WINDERS
Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Coil. See Winding Machines, Armature & Field Coil.
Electromagnet. See Winding Machines, Induction Coil.
Filament. See Machines, Lamp Making.
Induction Coil. See Winding Machines, Induction Coil.
Loop. See Winding Machines, Armature & Field Coil.
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Browning. See Mutual Foundry & Machine Co.
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Lessona. See Universal Winding Co.
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Copper Clad. See Wire, Copper Clad.
Forms. See Forms, Wire.
Frames. See Forms, Wire.
Fuse. See Fuses and Fuse Wire.
Molybdenum. See Molybdenum.
Phosphor Bronze. See Phosphor Bronze.
Platinum. See Platinum.
Radio Bus. See Wire, Bare.
Scrapers. See Scrapers, Wire.
Strippers. See Scrapers, Wire;
Tungsten. See Filament, Incandescent Lamp.
WIRE, Bare

Armature Banding	See S
Copper Wire	See C
Iron Wire	See S
Phosphor Bronze	See B
Radio Bus Wire	See C
Resistance Wire	See R
Steel Wire	See S

Acme. See Alloy Metal Wire Co.
Advance. See Driver Harris Wire Co.
Alloy Metal Wire Co., Moore, Pa. . . . . C R . .
American Brass Co., 25 Broadway, New York,
American Copper Products Corp., 233 Broadway, New York, N. Y. . . . . C R . .
American Electrical Works (Philipsdale), Providence, R. I. . . . . C . . . .
American Insulated Wire & Cable Co., Div. of General Cable Corp., 954 W. 21st, Chicago.... C . . S
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. . . . . C . . S
Anaconda Wire & Cable Co., Sycamore, Ill. . . . . C . . . .
Anylite Elec. Co., Fort Wayne, Ind. . . . . C . . . .
Ballast. See Gilby Wire Co.
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Beldenite. See Belden Mfg. Co.
Bradford, Kyle & Co., Plymouth, Mass. . . . . R . .
Braidite. See Cornish Wire Co.
Bronvar. See American Insulated Wire & Cable Co.
Bridgeport Brass Co., Bridgeport, Conn. . . . . C . . . .
Calido. See Driver Harris Wire Co.
Chromel. See Hoskins Mfg. Co.
Chromic. See Murray-Harris Wire Co.
Climax. See Driver Harris Wire Co.
Comet. See Driver Harris Wire Co.
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Copel. See Hoskins Mfg. Co.
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Cornish Wire Co., 30 Church, New York, N. Y.. C . . . .
Corwico. See Cornish Wire Co.
Crape. See Indiana Steel & Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J.. C . . . .
Cupron. See Gilby Wire Co.
Darow Mfg. Co., 97 Greene, New York, N. Y.... C . . . .
Detroit Insulated Wire Co., Detroit, Mich. . . . . C . . . .
1885. See Chicago Insulated Wire & Mfg. Co.
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Nichrome. See Driver Harris Wire Co.
Novar. See Standard Alloy Wire Co.
Page Steel & Wire Co., Bridgeport, Conn. . . . . S
Paranite. See Indiana Rubber & Insulated Wire Co.
Peerless. See Alloy Metal Wire Co.
Phillips Wire Co., Pawtucket, R. I. . . . . C . . . .
Phono-Electric. See Bridgeport Brass Co.
Premier. See Alloy Metal Wire Co.
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Silcrimp. See Valley Narrow Fabric Co.
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Annunciator, Office, Bell Wire	See A
Asbestos Covered Heater Cord	See H
Asbestos Covered Magnet Wire	See M
Enameled Magnet Wire	See M
Fixture Wire	See R
Flexible Reinforced Heavy Duty Cord	See F
Heater Cord	See H
Ignition Cable	See R
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Magnet Wire	See M
Rubber Covered Wire & Cable	See R
Stove Wire	See H
Telephone Cord	See T

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A-1 Brand. See American Insulated.
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Amelectric. See American Elec.
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American Electrical Works (Philipsdale), Providence, R. I. . . . . M
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American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. . . . . R F H A T M
Americore. See American Steel.
Amerite. See American Steel.
Amerixe. See American Steel.
Amparak. See American Steel.
Anaconda Wire & Cable Co., Sycamore, Ill. . . . . R W . . A . . M
Ansonia Electrical Co., Ansonia, Conn. Silk, Cotton, Enameled. . . . . A . . M
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WIRE, Insulated—Continued

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill. ..... R F H A T M
Beldenamel. See Belden Mfg. Co.
Beldenite. See Belden Mfg. Co.
Bishop Wire & Cable Corp., 420 E. 25th, New York, N. Y. ..... R F . . . . . .
Boston Insulated Wire & Cable Co., 65 Bay, Boston, Mass. ..... R F H . . . . .
Bradford, Kyle & Co., Plymouth, Mass. . . . . M
Cablex. See Collyer Insulated Wire Co.
Celatsite. See Acme Wire Co.
Collyer Insulated Wire Co., Pawtucket, R. I. ..... R F H . . . . .
Colorbeston. See General Elec. Co.
Condex. See Simplex Wire Co.
Colorubber. See Belden Mfg. Co.
Copperweld Steel Co., Rankin, Pa..... R . . . . . T . .
Cotenamel. See Belden Mfg. Co.
Cottonite. See Acme Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J. ..... R F H A T M
Darow Mfg. Co., 97 Greene, New York, R . . . . . .
Davis-Jones Insulated Wire Co., Pawtucket, R. I. ..... R F H A T . .
Deltabeston. See York Insulated.
Detroit Insulated Wire Co., Detroit, Mich. R . . . . . T . .
Diamond Braiding Mills, Chicago Heights R F H . . . M
Di-Noburn. See Diamond Braiding Mill.
Dreadnaught. See Indiana Rubber Co.
Driver-Harris Co., Harrison, N. J..... R . . H . . . . .
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.. . . . . M
Ducatto. See Dudlo Mfg. Co.
Durabilt. See Tubular Woven.
Duracord See Tubular Woven.
Durawire. See Tubular Woven.
Duro. See McEvoy, C. H.
Eagle. See Goldmark Co., James.
Eastern Insulated Wire Co., Tilton, N. H. R . . . . . .
1835. See Chicago Insulated Wire.
Enamelite. See Acme Wire Co.
Fibrex. See Simplex Wire Co.
Flexible Woven Cable Co., 755 Boylston, Boston, Mass. ..... F . . . . . .
Flex-O-Cord. See Packard Elec. Co.
Garco. See General Asbestos Co.
Gavitt Mfg. Co., West Brookfield, Mass. . . . . T . .
GE-Flex. See General Elec. Co.
General Asbestos & Rubber Co., Charleston, S. C. ..... H . . . . .
General Elec. Co., Section W-235, Merchandise Dept., Bridgeport, Conn.... R F H . . . . M
Giant. See Collyer Insulated Wire.
Goldmark Co., James, 83 Warren, New York, Annunciator and Asbestos, Cotton, Silk and Enameled Magnet ..... A . . M
Goodyear Rubber Insulating. See Graybar Electric Co.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y. R . . . . . T . .
Grimshaw See New York Ins.
Hatex. See Hatfield Rubber Wks.
Hatfield Rubber Wks., Inc., Hillside, N. J. ..... R F H . . T . .
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.... R F . . A . . .
Holyoke Co., 621 Broadway, New York.. R . . . A . . M
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... R F H . . . . .
I. X. L. See Collyer Insulated.
Kable. See Safety Cable Co.
Kenrite. See American Insulated.
Kerite Ins. Wire Cable Co., 30 Church, New York, N. Y. ..... R . . . . . T M
Kilo, Co., 2 E. 23d, New York..... . . . . T M
Koelle, Frederick C., Real Estate Trust Bldg. Philadelphia, Pa. .... T . .
Lowell Insulated Wire Co., Lowell, Mass. R F H . . . . .
Liberty. See Nat. Metal Molding
Loxsteel. See Hazard Insulated Wire Works.
McEvoy, C. H., Lowell, Mass..... R . . . . . T . .
Maring Wire Co., Muskegon, Mich. Cotton, Silk, Enameled ..... M
Marion Insulated Wire & Rubber Co., Marion, Ind. ..... R F H A T . .
Massachusetts Elec. Mfg. Co., West Lynn, Mass. ..... M
Montgomery Co., J. R., Windsor Locks, Conn. ..... T . .
National Elec. Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa..... R F H A T M
N. E. See Goldmark Co., James.
New York Insulated Wire Co., 114 Liberty, New York, N. Y. ..... R . . . . . .
Nitro. See Belden Mfg. Co.
O. K. See Phillips Wire Co. Also Southern Cable Co.
Okocord. See Okonite Co.
Okonite Co., Passaic, N. J..... R . . . . . .
Ozex. See Simplex Insulated Wire
Packard Electric Co., Warren, O..... R F . . . . . .
Parac. See Phillips Wire Co.
Paracore. See U. S. Rubber Co
Paraflex. See Bishop Wire & Cable.
Paranite. See Indiana Rubber.
Parkerite. See Seward Wire Co.
Peco See Packard Elec. Co.
Philadelphia Insulated Wire Co., 200 N. Third, Philadelphia, Pa. ..... H A T . .
Phillips Wire Co., Pawtucket, R. I..... R . . . . . .
Providence Insulated Wire Co., Providence R F H A . . . .
Raven Core. See New York.
Reliance. See American Steel.
Roebestos Products Corp., Nicoll & Conner Sts., New Haven, Conn..... R . . H . . T M
Roebling's Sons Co., John A., Trenton, N. J. ..... R F H A T M
Rome Electrical Co., Rome, N. Y. ..... M
Rome Wire Co., Rome, N. Y..... R F H . . T M
Ross Wire Co., 69 Bath, Providence, R. I.. R . . . . . .
Runzel-Lenz Elec. Mfg. Co., 1751 N. Western Ave., Chicago, Ill..... . . . . T . .
Safety Cable Co. (Div. of General Cable Corp.), New York ..... R F H . . . . .
Salamander. See York Insulated.
Seward Wire Co., Parkersburg, W. Va. R . . . . . .
Silkenamel. See Belden Mfg. Co
Silkenite. See Acme Wire Co.
Simcore. See Simplex Wire.
Simplex Wire & Cable Co., 63 Sydney, Cambridge, Mass. ..... R F . . . . . .
Shield. See Ansonia Elec'l Co.
Southern States Cable Co., Div. of General Cable Corp., Mobile, Ala..... . . . . M
Spiralweave. See Hazard Ins. Wire
Standard Alloy Wire Co., Elizabeth, N. J. .... H . . . . .
Standard Insulated Wire Co., Westfield, Mass. ..... R . . H . . . . .
Standard Underground Cable Co., Pittsburgh, Pa. (Div. of General Cable.) R F H A T . .
Sterling. See Standard Underground.
Sterling Insulated Wire Co., Fall River, Mass. ..... R . . . . . .
Strand & Sweet Mfg. Co., Winsted, Conn. . . . . M
Super-Service. See Rome Wire Co.
Sweetstrand. See Strand & Sweet.
Tip-Top. See Standard Underground.
Tirex. See Simplex Wire & Cable.
Trenchlay. See Rome Wire Co.
Triangle Conduit Co., Dry Harbor Rd. & Cooper Ave., Brooklyn..... R . . . . . .
Tubular Woven Fabric Co., Pawtucket, R. I. ..... R F . . . . . .
United States Rubber Co., 1790 Broadway, New York, N. Y..... R . . H A T . .
U. S. Royal. See United States.
Varflex Corp., Rome, N. Y. ..... M
Warrior. See American Copper.
Wheeler Insulated Wire Co., Bridgeport, Conn. ..... R F H A T M
White, J. M., 1128 Oliver, Philadelphia, Pa. ..... R F H . . T . .
Whitney Blake Co. See Graybar Electric Co.
Wovenite. See Flexible Woven.
York Insulated Wire Wks. of G. E. Co., 120 Broadway, New York, N. Y..... R . . H . . . M

WIRE, Steel Flat

Steel Coating for Armored Conductor.
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill.
Crescent Insulated Wire & Cable Co., 319 N. Oden Ave., Trenton, N. J.
Roebling's Sons Co., John A., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.

WIRE MANUFACTURING MACHINES

(See Also Wire Drawing Machines; Insulation Mixers; Taping Machines, Wire; Wire Polishing Machines; Enameling Machines for Magnet Wire; Wire Wrapping Machines; Vulcanizers, Wire Insulation.)

Armoring Machines ..... See A
Braiding Machines ..... See B
Bunching Machines ..... See S
Covering Machines ..... See I
Insulating Machines ..... See I
Insulation Straining Machines..... See I
Measuring Machines ..... See M
Park Cabling Machines..... See A
Saturating Tanks ..... See F
Spooling Machines ..... See U
Stranding Machines ..... See S
Tinning Tanks ..... See F
Winding Reels ..... See U

Adamson Machine Co., Akron, Ohio.. I A . . . . . .
Aimco-Seward. See American Insulating Machinery Co.
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa. I A . . . S U F
Breguet. See American Insulating
Crescent. See Royle & Sons, John.
Durant Mfg. Co., 662 Buffum, Milwaukee, Wis. ..... M . . U . .
Housatonic Machine & Tool Co., Bridgeport, Conn. ..... I . . . . . U . .
Minneapolis Elec. & Construction Co., 80 S. 12th St., Minneapolis, Minn. . . . . M . . U . .
Nebutteo. See New England Butt Co.
New England Butt Co., 324 Pearl, Providence, R. I. ..... I A B M S U . .
Peerless. See Royle & Sons, John.
Royle & Sons, John, Paterson, N. J. I . . . . . .
Sleeper & Hartley, Inc., Worcester, Mass. ..... A . . . S U
Terkelson Machine Co., 326 A St., Boston, Mass. ..... M . . . . .
Textile Machine Works, Reading, Pa. . . . B . . . . .
Universal Wire Machy. Co., 69 Daggett, New Haven, Conn. ..... A . . . . U F
Utility Mfg. Co., Cudahy, Wis..... I . . . . . .
Wardwell Braiding Machine Co., Central Falls, R. I. ..... B . . . . .
Wire Machinery Corp. of Am., New Haven, Conn. ..... M S U . .
Weir. See Housatonic Machine

WIRE POLISHING MACHINES

(See Also Wire Manufacturing Machines).
American Insulating Machinery Co., 519 Huntington Ave. Philadelphia, Pa.
New England Butt Co., 324 Pearl, Providence, R. I.

WIRE STRAIGHTENING MACHINES

Kane & Roach, Syracuse, N. Y.
Shuster Co., F. B., New Haven, Conn.

WIRE TAPING MACHINES. See Taping Machines, Wire.

WIRE VULCANIZING MACHINES. See Vulcanizers Wire Insulation.

WIRE WRAPPING MACHINES

Terkelson Machine Co., 326 A St., Boston, Mass.

WOOD BLOCKS. See Cabinets & Boxes, Wood.
Boxes. See Cabinets & Boxes, Wood
Cabinets. See Cabinets & Boxes, Wood
Pulleys. See Pulleys, Composition.
Wood Metal. See Radio Mountings.

WRAPPERS, Paper. See Boxes and Wrappers.

WRAPPERS, Tungsten Lamp. See Boxes and Wrappers.

WRAPPING MACHINES, WIRE. See Wire Wrapping Machines.

YARN AND THREAD; Silk, Cotton, Asbestos

American Asbestos Co., Norristown, Pa.
American Glanzstopf Corp., 180 Madison Ave., New York, N. Y.
Asbestos Fibre Spinning Co., North Wales, Pa.
Commercial Rayon & Thread Co., 19 W. 21st, New York, N. Y.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
Florsheim, H. A., 225 Fifth Ave., New York, N. Y.
Franklin Rayon Corp., 86 Crary, Providence, R. I.
General Electric Co., Schenectady, N. Y.
Great Lakes Yarn & Thread Co., 5133 Wesson Ave., Detroit, Mich.
Johns-Manville Corp., New York, N. Y. (Asbestos.)
Multiple Winding Co., 77 Summer, Boston, Mass.
Rich & Co., H. S., 180 S. Water, Providence, R. I.
Tyle & Co., Wm., 381 Fourth Ave., New York, N. Y.
Silkslip. See Worcester Bleach & Dye Wks. Co.
Smith & Dove Mfg. Co., Andover, Mass. (Linen Thread.)
Worcester Bleach & Dye Wks., Worcester, Mass.

ZINC

Horse Head. See New Jersey Zinc Sales Co.
New Jersey Zinc Sales Co., 160 Front, New York, N. Y.
Platt Bros. & Co., Waterbury, Conn. (Strips.)

ZINCS AND COPPERS, Battery

Bunnell & Co., J. H., 32 Park Pl., New York, N. Y.
Edes Mfg. Co., Plymouth, Mass.
Extruded Metal Corp., 181 53rd, Brooklyn, N.Y. (Zinc Cups.)
Franklin. See Grasselli Chemical Co.
Grasselli Chemical Co., Guardian Bldg., Cleveland O
Illinois Zinc Co., Peru, Ill.
Lind Mfg. Co. 70 Wyckoff Ave., Brooklyn, N.Y. (Zinc Cups.)
Matthiessen & Hegeler Zinc Co., La Salle, Ill
New Jersey Zinc Sales Co., 160 Front, New York, N. Y.

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D. C. Compound Wound
A. C. Polyphase
Interchangeability of Frames

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U. S. A.

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25% *Locked Service:* For services where the motor is locked across the line 25% of the time; that is, say, 15 seconds on and 45 seconds off. This type may remain locked across the line for 20 minutes without injury to the motor.

10% *Locked Service:* For services where the motor is locked across the line about 10% of the time; that is, say, 6 seconds on and 54 seconds off. This type may be left locked across the line for 10 minutes without injury to the motor.

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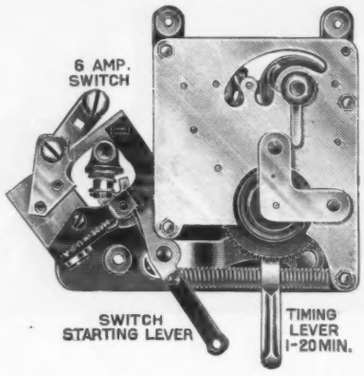

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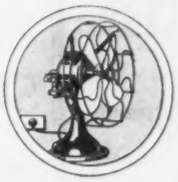

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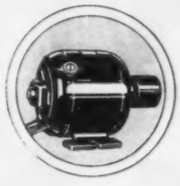
Blowers	Driers	Office Appliances	Ticket Selling Machines
Brick Machinery	Floor Surfacers	Organ Blowers	Vacuum Cleaners
Churns	Folding Machines	Mailing Machines	Ventilating Fans
Cloth Cutters	Heaters	Machine Tools	Unit Heaters
Coffee Mills	Heat Regulators	Meat Choppers	Washing Machines
Coin Counters	Hoists	Milking Machines	Wrapping Machines

Robbins & Myers, Inc.

Springfield, Ohio **Brantford, Ontario**

1878



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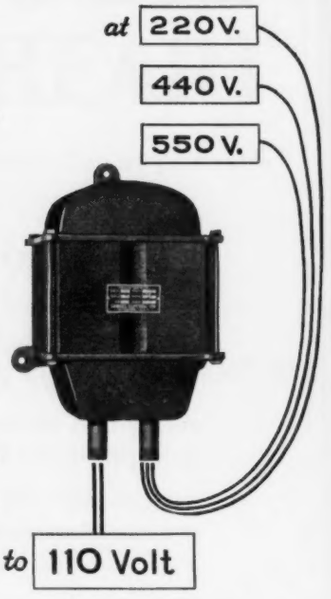

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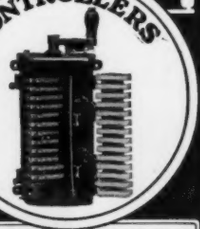

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Standard-Special Explosion Proof For all Purposes A.C.-D.C.

Production Tester—
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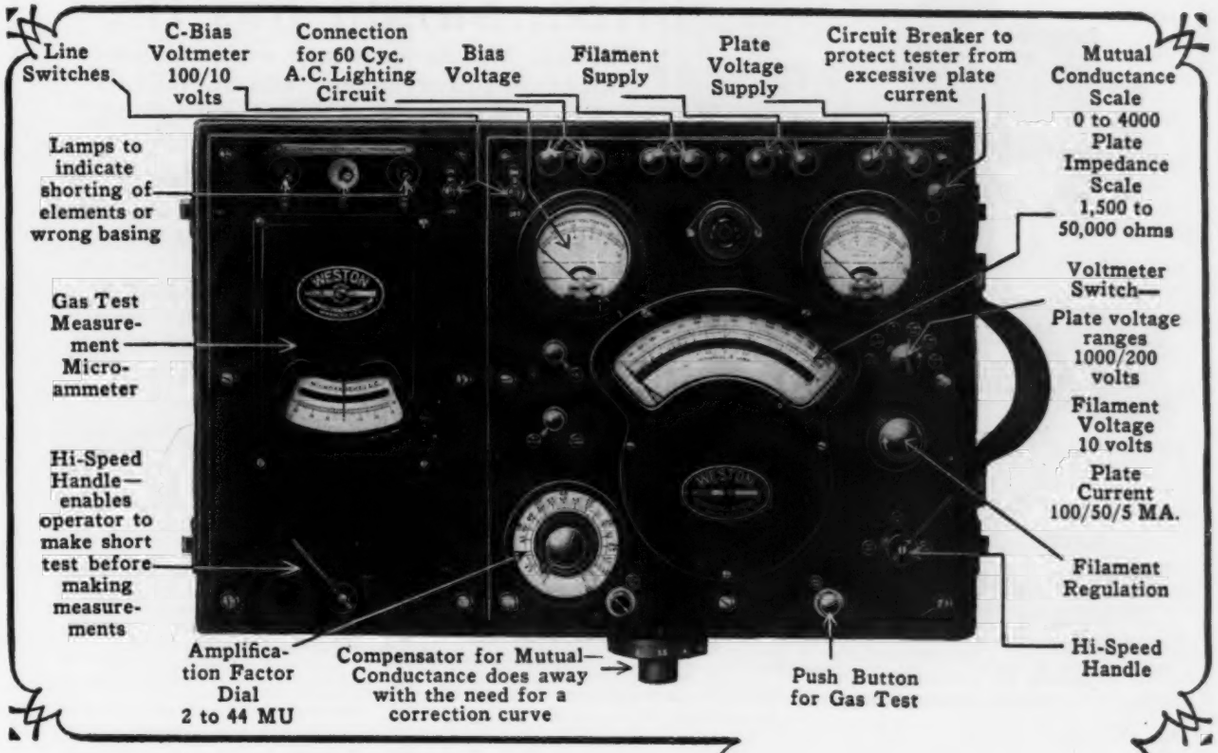
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Filament Voltage 10 volts
Plate Current 100/50/5 MA.
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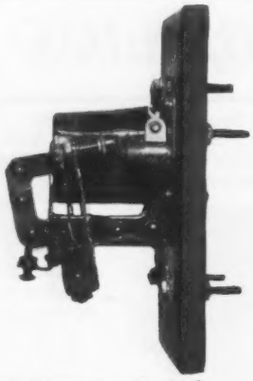
Weston
PIONEERS SINCE 1888
INSTRUMENTS

Sundh *Special* Control designed today becomes *Standard* tomorrow



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This relay is manufactured in two capacities, 3 and 6 amperes, for all voltages, 6 to 550 volts, either A.C. or D.C., and is made in 1, 2, 3 and 4 poles; 2-pole double throw, also with 1 or 2 poles, normally closed with 1 or 2 poles normally open, using one magnet.

...if it must be electrically controlled, *Sundh* has the answer

Electrical Manufacturers and engineers from coast to coast have consulted with SUNDH on problems involving the electrical control of motors and lighting systems.

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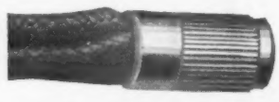

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Pin-Plug Connectors

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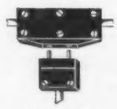

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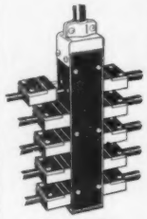

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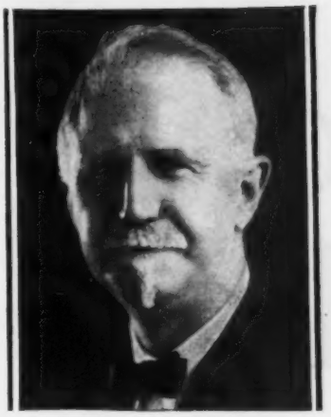

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for many uses are preferable to silver or tungsten . . . .

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No. 10 Alloy possesses higher arc-resisting qualities than the various grades of silver used in contact points, and compares, size for size, very favorably in price.

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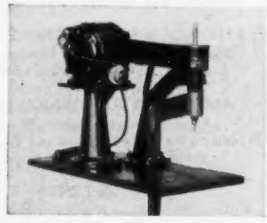

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FLEXIBLE SHAFT EQUIPMENTS MANY TYPES AND SIZES ⅛ to 2 H.P.

Power screw driving attachment.

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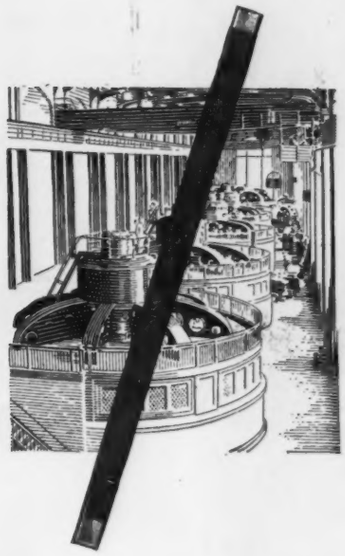

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At Conowingo, the generating station of the Philadelphia Electric Company has an ultimate capacity of nearly 600,000 kv-a. This vast development embodies the most advanced engineering practice. And accordingly, Deltabeston magnet wire was used in the four G-E generators—for field-coil windings. Engineers who plan ahead—years ahead—specify Deltabeston for big jobs.

There are special types for motors, heating units, and railroad service. Samples are available upon inquiry. Test them in any manner you wish.

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of General Electric
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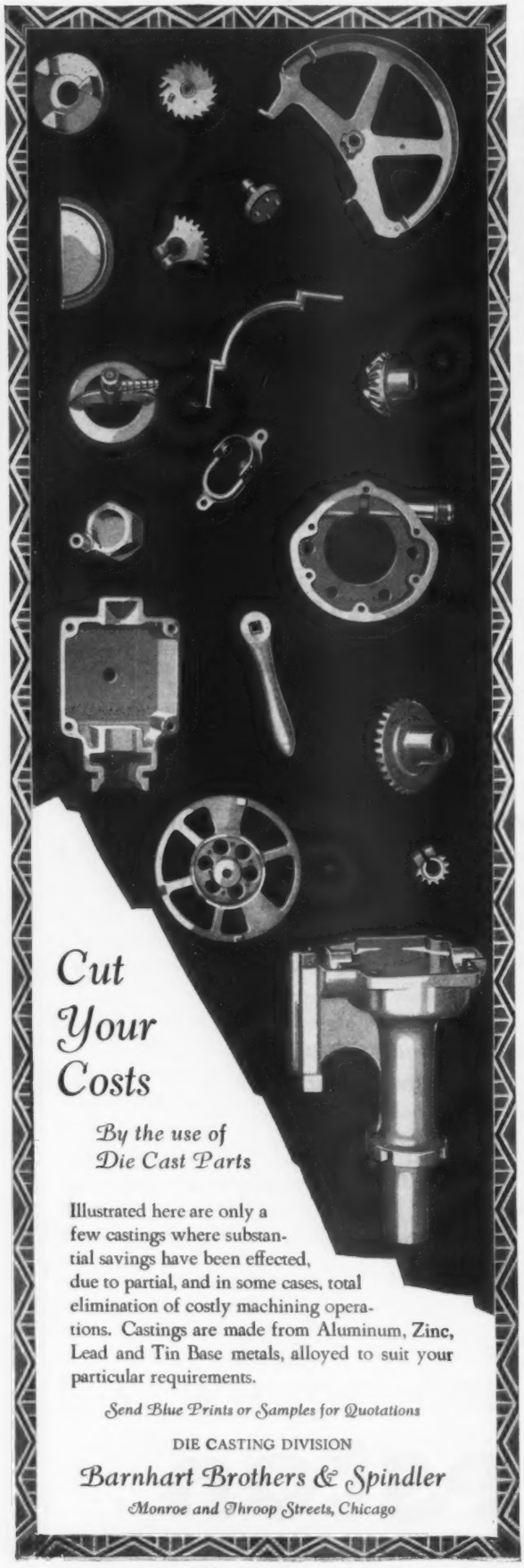
YI-5

Deltabeston

THE WIRE WITH THE LONG FIBRE ASBESTOS



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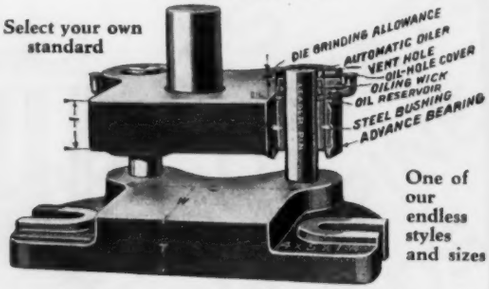

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CENTRAL 7813-4

STAND-BY,* *n. One who, or that which, stands by one in need; something upon which one relies for constant use.*
ACCORDING TO WEBSTER

THE richest memories of childhood days are grouped around Santa Claus. To be sure, he was only an illusion; but childhood is made of imaginary things that seem a bit finer than most of the raw realities faced by men. And to little children, Santa Claus is the finest of good friends, in whom they have an abiding trust; and he was our old stand-by, who never left the stocking empty.

The manufacturer of electric heating devices has also found an old *stand-by in Chromel—for his heating-elements. He has found Chromel to be uniform in resistance, to stretch evenly, and have a clean finish free from slivers. These good points appeal to him from a production viewpoint. But, more than that, the behavior of Chromel in the device is such as to safeguard the good-will value of his good name.

A new catalog has just been issued, giving complete technical data on Chromel that would be helpful to your engineering department. If you want a copy, ask for Catalog F.M.

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4445 Lawton Avenue, Detroit, Michigan
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All Products Made to Recognized Commercial Standards including those of:
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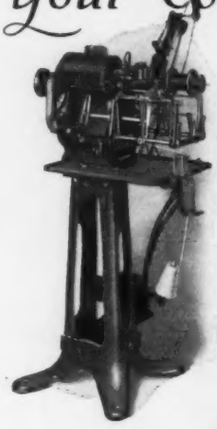

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"Universal"
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and insure uniform production of dependable coils at surprisingly low cost

or

Purchase these same coils from us, carefully wound to your specifications and ready for application to your product

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☐ Send me Production Chair No. 1005-W for a month's FREE TRIAL.
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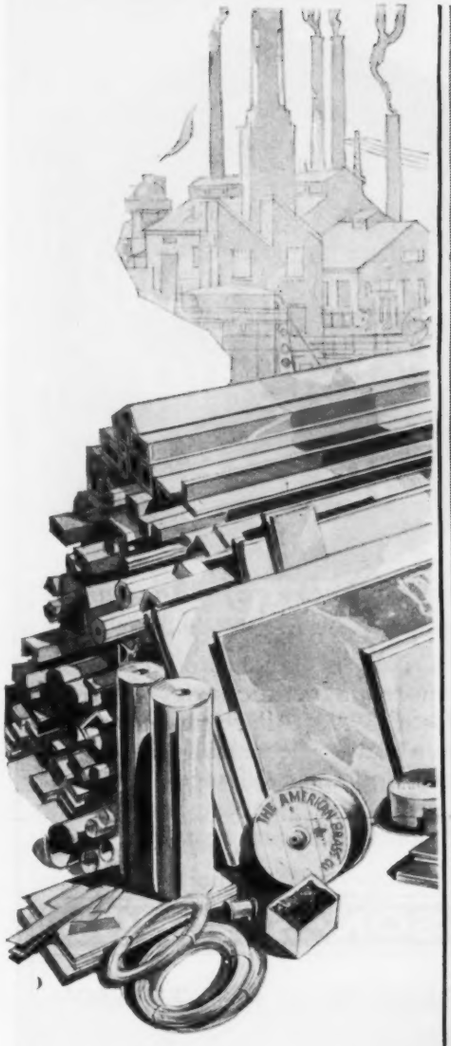

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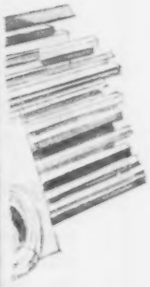

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Tubes	Copper, Brass and Special Alloys Phosphor Bronze—for bushings, etc. Bus Tubes—High conductivity Copper—Special grades for bending, flanging and expanding
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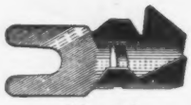
SHERMAN TERMINALS



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As the largest manufacturers of terminals in the world, we have developed a line in which every need will find a terminal exactly suited to it.

Our superior production methods enable us to turn out brass and copper wire and cable terminals of great electrical efficiency at low cost. You will find them the most dependable and economical for every purpose.

No. 3

Do not be deceived by cheap and flimsy products; SHERMAN TERMINALS are made for service and are thoroughly guaranteed. Ask for bulletins and any special information—our engineering staff will be glad to help in any way.

No. 281

The only COMPLETE line

. . . and remember, also, that

SHERMAN is HEADQUARTERS for *all* Terminals

No. 10

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ANY MATERIAL OR QUANTITY
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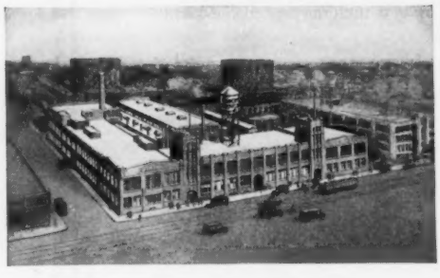

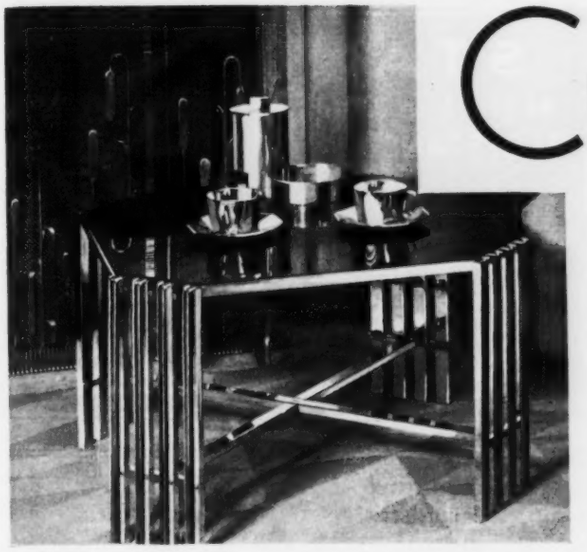

CHROMIUM

The NEW IDEA...

IT requires but ten seconds on the corner of any busy highway to realize how the Chromium idea has manifested itself in the motor world.

It needs but a few minutes in any wide-awake shop to discover that Chromium Plated merchandise is being asked for—actually demanded!

Progressive manufacturers can meet this situation immediately, successfully . . . with the help of United Chromium, Inc.

United Chromium, Inc., is organized to render a valuable licensing service. This service assures manufacturers of the finest Chromium Plating on a definite production basis. It relieves them of uncertainty; guards them against failure and the losses due to rejects... It includes the supervision of new plant installations; coaching of platers and control and maintenance of solutions by periodic tests.

It would be a pleasure to send details of this licensing service to manufacturers who contemplate using Chromium Plate on their products. Names of our jobbing licensees will be sent to manufacturers whose present needs do not justify their own plating department.

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INCORPORATED

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MARING Magnet Wire advantages are not theoretical. Numerous tests guarantee its quality before it leaves our stockrooms. Users everywhere testify to its value, dependability and specific superiority.

All factory tests are conducted in accordance with the standards of the American Society for Testing Materials.

Notable characteristics of "MARING" are:

"Dead" Softness: This is secured by a uniform exclusive MARING annealing process which insures easy workability and utmost pliability.

High Dielectric Strength: "MARING" carries an almost unbelievable "load," guaranteeing longer life and lowered maintenance costs.

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Insulation Uniformity: No bare spots or imperfections to cause trouble.

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ANGLE STEEL Posture Chairs Protect Profits!

Lightweight steel frame assures greatest strength and permanency. Seat height adjusts from 17" to 22". Form-fitting seat and back, padded and genuine leather-covered. Backrest adjusts up and down and tilts to any angle desired. Steel frame may be finished in olive-green, black or red enamel. Leather seat furnished in red, blue, green and brown leather. 2" rubold wheel casters.

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Revolving Seat Type

TOP production and your profits are dependent upon proper seating—either in office or factory.

Over-fatigue (which is often the result of tired muscles of the neck, chest, back and abdomen) is impossible with ANGLE STEEL "PEP" Posture Chairs.

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HEAT ALONE IS NOT SUFFICIENT FOR ARMATURE BAKING

It takes more than heat to properly bake an armature or a field coil.

The baking of a dipped coil or armature is probably the most important of the series of operations through which it passes. Under-baking will leave the varnish soft and liable to be thrown off by the centrifugal force of the rotating armature, leaving it unprotected and out of balance. The remaining solvent and thinner in underbaked portions also decrease the dielectric strength and are apt to promote deterioration in both fabric and insulation. Overbaked insulation represents an economic loss in heat consumed beyond that necessary to bring the process to its proper point. But more important still, it also tends to shorten the effective life of the varnish in service.

It is therefore very important in baking to maintain the proper oven temperature and to hold all parts of the oven at the same temperature, to get uniformity of bake throughout. The fumes and gases from the volatile oils driven off by heat must be removed immediately in order to maintain the most effective drying conditions in the oven. Oxygen in sufficient quantity must be available in order to properly oxidize the heavier oils in the varnish compound.

For large armatures with deep windings, the better practice is to begin the bake with a temperature of about 150° F., holding this for about one hour before the maximum temperature is reached. This preliminary low temperature bake allows a thorough volatilization of the lighter oils from the interior of the coils before the oxidation of the outer layers has proceeded far enough to trap them. This precaution is not necessary with the shallower windings.

The volatiles having been driven off, the oven is brought to full baking temperature and oxidation of the heavier oils is carried on. Full baking temperatures range from 200° to 250° F., the duration of the bake from 5 to 48 hours on large magnet and field coils.

To meet successfully these requirements it is essential that baking time, temperature and air conditioning be constantly under close control. And the control of these factors can only be obtained in an oven that is properly constructed, properly heated and properly ventilated—in short an oven intelligently designed and built for a specific purpose.

In view of the recognized economy of trouble-free motors, it is just good business to use the procedure and equipment which will produce a strong, durable protection for the armature windings.

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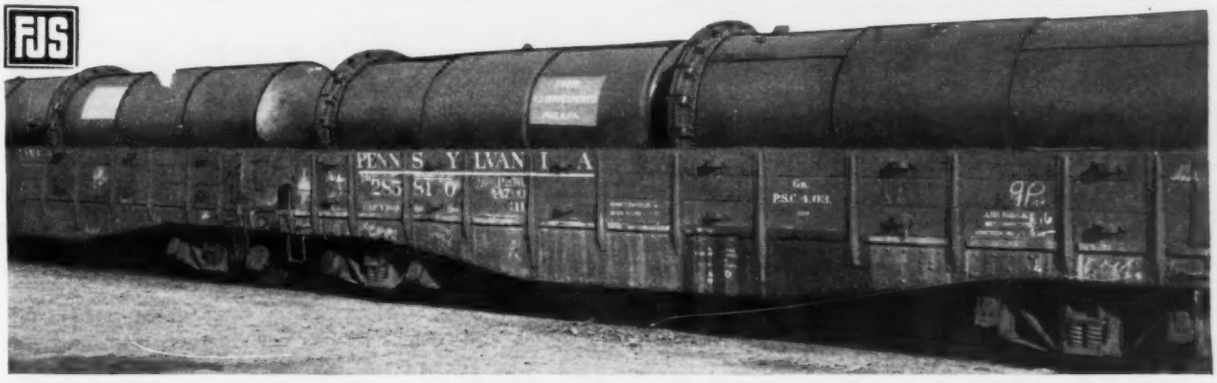

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We build tanks to any required size and furnish complete equipment—condensers, high vacuum pumps, compound coolers. We will gladly advise regarding your impregnating problem and recommend the equipment needed.

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per day.
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Process Machinery Since 1895
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Dependability

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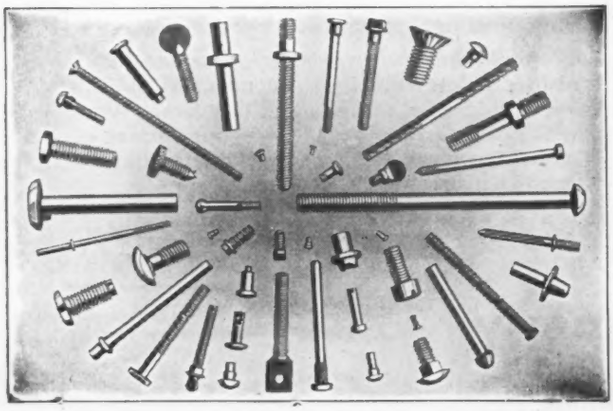

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SPECIAL STUDS
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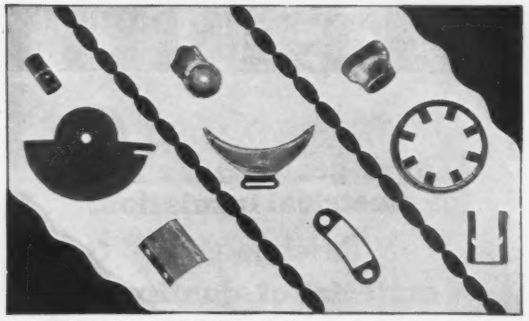

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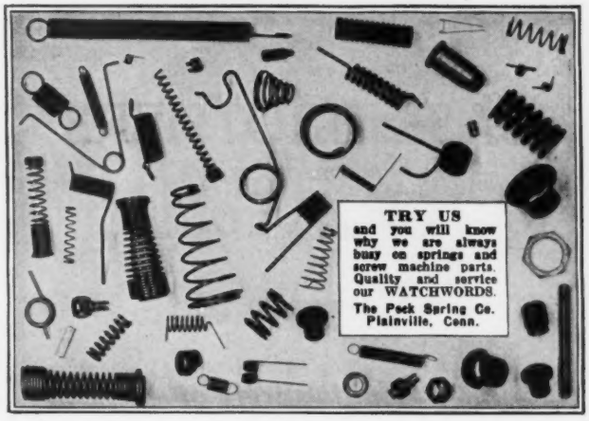
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and you will know why we are always busy on springs and screw machine parts. Quality and service our WATCHWORDS.
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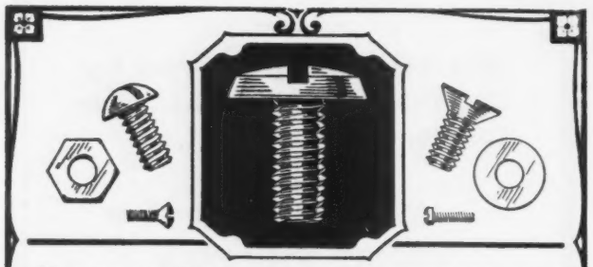

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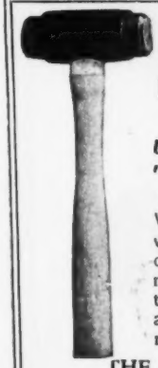

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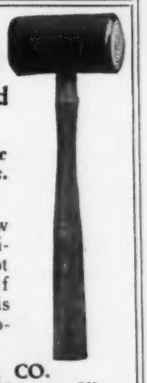
Will transmit an effective blow without damage to the most delicate surface. The blow is not more destructive to the tool itself than to the object to which it is applied—therefore, doubly economical.



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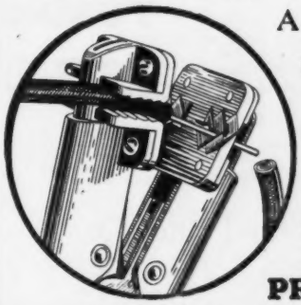

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Here is a tool that will save you time and money, speed up production and lower your costs.

This inexpensive tool strips wire of 10 to 20 gauge 20 times faster than usual methods. Give it a trial on a money back guarantee. Thousands in use.

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FLUX-CORE

M&W.Co. 1876

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Not merely an Expression but a *Result.*

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to the Motor Manufacturer
and Repair Man

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STICKS tape ends instantly, and you know that
TIME saved is money in your pocket. This glue
IS absolutely neutral, and
CAN be applied very easily. It will
KEEP your tape well glued and
ELIMINATE clamps, or the more expensive shellacs.
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"Style at any price" is not Good Business for you, But style at low production costs Means sales-and savings too!

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Zellac is manufactured and sold on a basis of highest possible quality at lowest possible price. Let us prove this to you in a trial order, *specifically formulated to meet any special requirements that you may care to describe to us.*

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FOR EVERY INDUSTRIAL PURPOSE
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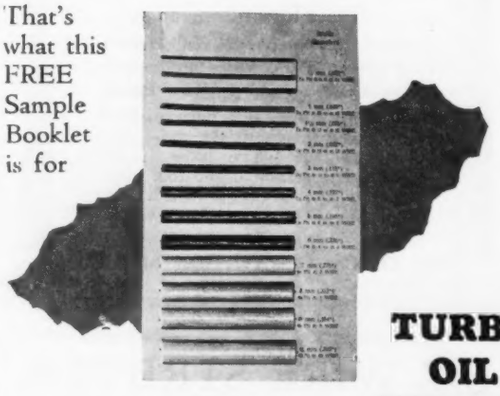
A test is best, always

That's what this FREE Sample Booklet is for



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The enemy of "Corona" action!

A word to the wise electrical manufacturer is enough; put a few samples of TURBO Oil Tubing through your toughest tests. It is the highest grade of spaghetti made, and its flexible toughness makes it unsurpassed for lead wire insulation. Turbo is baked and impregnated, not dipped; and is proof against weather, moisture, oils or acids.

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concerned with increasing sales—

What attribute of a business paper is the most important in your consideration?

Circulation?
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Power to stimulate Sales?
Quality of circulation?
Renewal percentage?
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Character of editorial contents?
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Or do other factors enter into your consideration?

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Electrical Record

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by Hunter

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Cadmium Plated Springs

are rust and corrosion proof. We are equipped to finish springs and wire forms with this modern process that has proved so successful with electrical equipment.

A new booklet of interest to *all* buyers . . . is now being prepared for all those who are looking for non-technical information about springs. It is entitled "Spring Buyers," and will be sent to all interested executives.

HUNTER PRESSED STEEL CO.

Lansdale, Pa.

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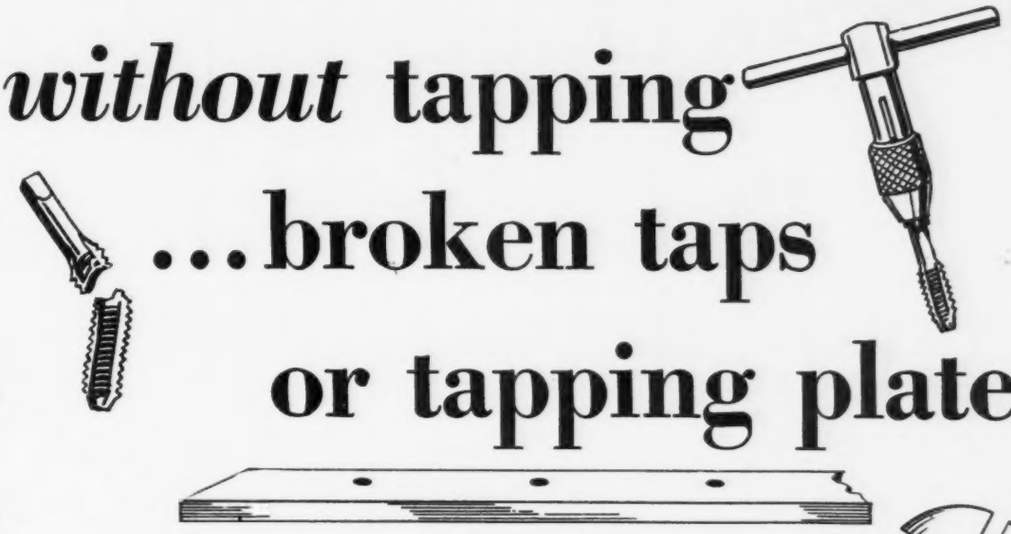
Fasten thin sheet metal *without* tapping ...broken taps or tapping plates



Just punch a hole and turn in this Self-tapping Screw

HOLES cannot be successfully tapped into thin sheet metal unless a tapping plate or other auxiliary device is used to provide a sufficiently heavy cross section for tapping.

With Parker-Kalon Hardened Self-tapping Sheet Metal Screws secure fastenings can be made to the thinnest of sheet metal . . . easily and quickly. No slow, costly tapping necessary . . . no broken taps . . . no tapping plates. The time, labor and cost of making assemblies is reduced considerably.

Self-tapping Screws cut their own thread in the sheet metal. Just turn them into a pierced or drilled hole with a screw driver.

Assemblies made by such concerns as General Electric, Western Electric, Westinghouse, Cutler-Hammer and many other electrical manufacturers prove that these unique Screws stand up under vibration and severe service.

With Self-tapping Screws you can cut the time and cost of assembling thin sheet metal or metal as heavy as 10 gauge (0.140"). And for making secure fastenings to slate, die castings, Bakelite, etc., these Screws cannot be surpassed for ease and economy.

How many places in assembling your products can you use Self-tapping Screws profitably? It will pay you to find out and try the free samples we'll send. Just tell us what you want to fasten.

PARKER-KALON CORPORATION
190-204 Varick Street, New York, N. Y.

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PARKER-KALON
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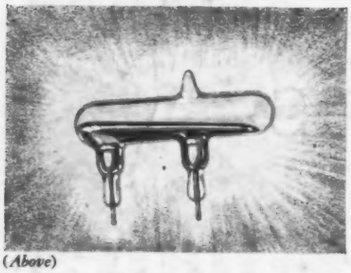
Sheet Metal Screws

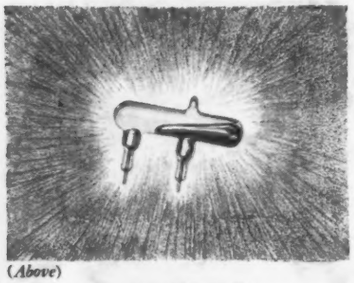
PATENTED
APR. 1, 1919 - No. 1299232 — MAR. 28, 1922 - No. 1411184
AUG. 14, 1923 - No. 1465148 — FEB. 10, 1925 - No. 1526182
OTHERS PENDING

A dependable switch

with long life and high capacity



(*Above*)
Kon-nec-tor 7-10KRO (Unmounted, half actual size) designed for currents as high as 25 amperes, voltages up to 250, total wattage capacity 2400, non-inductive load. Shown in *closed* position, tilted 5 degrees.



(*Above*)
Kon-nec-tor 4-21KRO (Unmounted, half actual size) designed for currents up to 15 amperes, voltages up to 250, total wattage capacity 1200, non-inductive load. Shown in *open* position, tilted 10 degrees.

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A mercury pool breaks the circuit by dividing and makes it again by uniting at the next oscillation. This pool is sealed within a hard glass tube filled with inert gas which stops arcing and dissipates heat, literally for millions of cycles.

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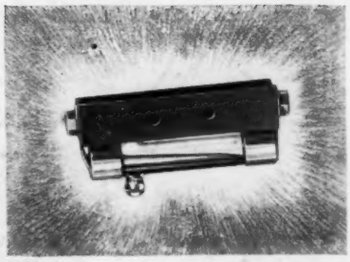

(*Above*)
Kon-nec-tor 3-11 KR4 (Mounted below Bakelite block, half actual size) designed for currents up to 5 amperes, voltages up to 250, total capacity 600 watts, non-inductive load. Shown in *closed* position, tilted 5 degrees.

(*Above*)
Kon-nec-tor 3-11KR3 (Mounted above Bakelite block, half actual size) designed for currents up to 5 amperes, and voltages up to 250, total capacity 600 watts, non-inductive load. Shown in *open* position, tilted 10 degrees.

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KON-NEC-TORS *are applied commercially today in the following, among many other uses*

PRESSURE CONTROLS
TEMPERATURE CONTROLS
TIME CONTROLS
FLOAT CONTROLS
WEIGHING MACHINE CONTROLS
SIGN FLASHERS
ELEVATOR LIMIT SWITCHES
SAFETY SWITCHES
REVERSE-PHASE RELAYS
TOGGLE SWITCHES
STREET LIGHTING CONTROL SWITCHES
TRAFFIC CONTROLS AND FLASHING BEACONS, ETC.

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